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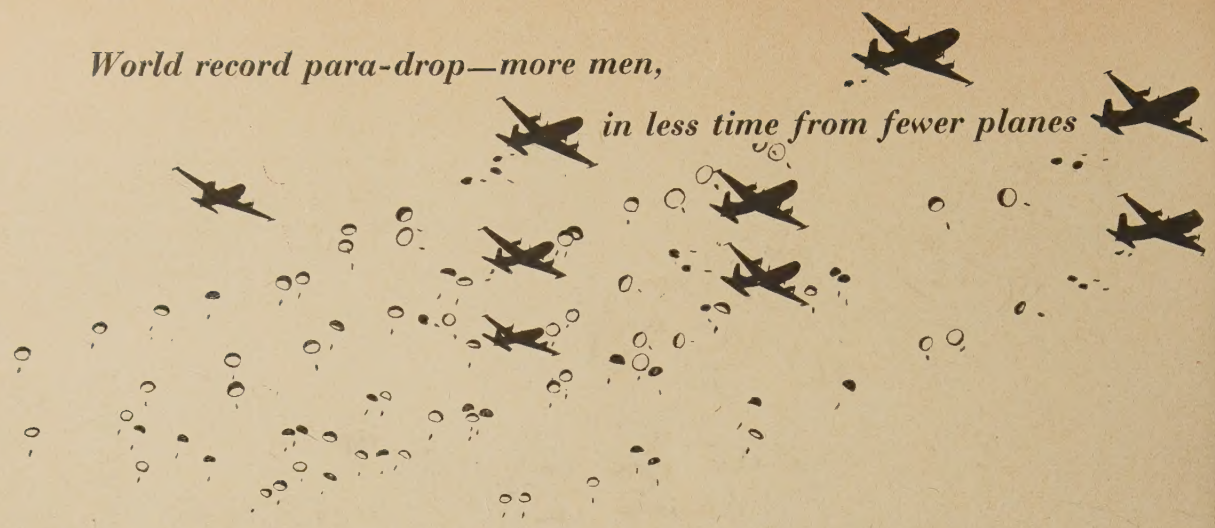
AYS Round Table: Opera-
Weather Problems

World record para-drop—more men,

in less time from fewer planes



with the—**Douglas C-124 Globemaster**

Nine Douglas C-124 Globemasters of the 18th Air Force, 62nd Group, 7th Squadron, cruised above Fort Bragg. Seconds later, more than a thousand paratroopers had hit the silk... were floating down on the drop zone.

For this record-breaking drop, Globemaster—the Air Force's largest operational transport plane—was a logical choice. Clamshell doors, located in the nose, make loading of troops or matériel fast and easy. Load space is two stories high... gross weight at take-off, 87½ tons. A single Globemaster can transport 200 armed troops across the Atlantic—deliver 25-ton loads of tanks, cranes, loaded trucks to fill immediate needs at bases anywhere in the world.

Performance of the C-124 Globemaster is another example of Douglas leadership in aviation. Planes that can be produced in quantity to fly *faster and farther with a bigger payload* is a basic rule of Douglas design.

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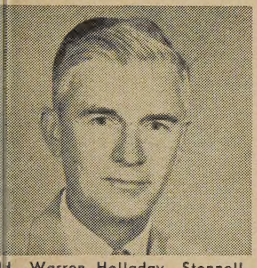
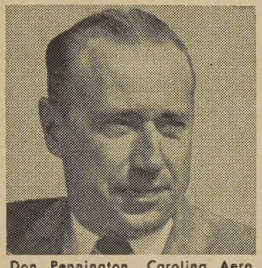
Fred Smith, Sales Manager, AiResearch Aviation Service Co., 5907 W. Imperial Highway, Los Angeles 45, California.

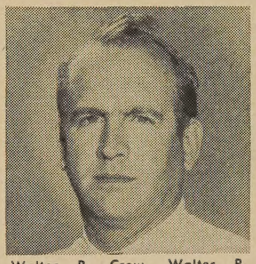


H Warren Holladay, Stonnell and Holladay, Easton Municipal Airport, Easton, Md.

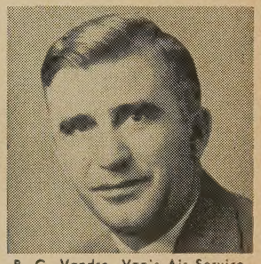


Don Pennington, Carolina Aero Company, Municipal Airport, Asheville, North Carolina.

George Harte, Harte Flying Service Municipal Airport, Wichita, Kansas.



Walter R. Crow, Walter R. Crow, Inc., Municipal Airport, Toledo, Ohio.



B. G. Vandre, Van's Air Service, Municipal Airport, St. Cloud, Minnesota.

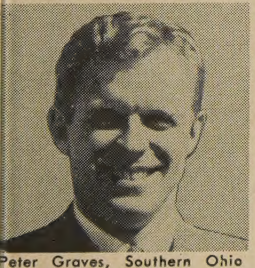
C. W. "Wayne" Crussell, Southern Aero, Inc., Municipal Airport, Atlanta, Georgia.

Cheston M "Chet" Newhall, The Babb Co (Canada) Ltd., Montreal Airport, Dorval, P.Q.

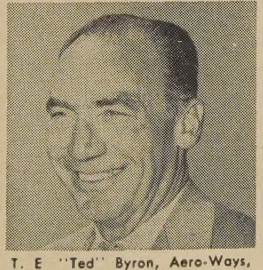
Art Meurer, Arthur Meurer Co., Inc., LaGuardia Field, New York, N. Y.

I H. "Monty" Montgomery, National Aero Sales Corp., Midway Airport, Chicago, Ill.

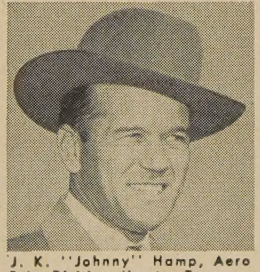
Don Hood, Air Sales and Service Company, Wier Cook Municipal Airport, Indianapolis, Indiana.



Peter Graves, Southern Ohio Aviation Company, Inc., Dayton Municipal Airport, Vandalia, Ohio.



T. E "Ted" Byron, Aero-Ways, Inc., Municipal Airport, Cleveland, Ohio.



J. K. "Johnny" Hamp, Aero Sales Division, Houston Transportation Co., Municipal Airport, Houston, Texas.

Cy Willock, Sales Manager Downtown Air-Park Inc, 1800 South Western, Oklahoma City, Oklahoma

H. Leibee Wheeler, Buffalo Aeronautical Corporation, Buffalo Municipal Airport, Buffalo, New York.

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DECEMBER, 1953

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Lockheed
Continental Defenders Comprise Unique Team

Of all U. S. aircraft manufacturers, the Lockheed Aircraft Corporation today produces the most complete team of airplanes capable of nearly every function of air defense.

With increasing emphasis on continental defense needs, Lockheed is building a record volume of specialized defenders of many types. And production of all Lockheed models is on schedule.

Important members of this Lockheed defense team are these three airplanes:

1. EARLY WARNING—Lockheed Super Constellations, with distinctive radar humps, are "flying radar stations" capable of hovering long hours at high altitude far beyond U. S. borders to warn against attack. (Called WV-2 by Navy, RC-121-D by Air Force.)

2. FLYING SENTRY—For long-range, long-endurance patrols at lower levels, the Navy uses P2V Neptune Bombers, especially designed to protect U. S. coastlines from sneak attack by submarine. Secondary missions: rocket attack, mine laying, torpedo attack, photo reconnaissance.

3. ALL-WEATHER JET INTERCEPTOR—While both the Early Warning Aircraft and the P2V Neptunes are on constant patrol, Lockheed F-94 Starfires are based at strategic continental points, ready to intercept any attacker in daylight or darkness, regardless of weather.

Peace today is as firm as the strength behind it, and other Lockheed models in production contribute toward this peace. These include the T-33 Jet Trainer (Navy, TV-2) in which 9 out of 10 of our jet pilots earn their wings, and the C-130 military transport, only transport designed from the ground up for turboprop power.

PLANS FOR TOMORROW'S PLANES—Several new Lockheed models will be tested early next year. One of these will be the XF-104 Day Superiority Fighter. Others are too secret to be talked about. And designs 10 to 15 years from now are now taking shape in research by a special corps of engineer-scientists at Lockheed.

now hear this . . .

PERSONNEL

Charles C. Busenkell has been named executive engineer in charge of West Coast operations of Continental Aviation & Engineering Corp.

Col. R. W. Knight recently was appointed Assistant to the President of Resort Airlines. Col. Knight also will serve as Director of Safety.

Miss L. I. Houseman, R. N., is now Chief Stewardess of Trans-Canada Air Lines.

Richard M. Degan has been appointed Chief Engineer of Hydro-Aire, Inc. Mr. Degan is in charge of all engineering functions and activities at Hydro-Aire.

Joseph A. Anderson recently was named general manager of the AC Spark Plug Division of General Motors.

Dean C. Smith has joined Lear, Inc., as Director of Customer Relations. His headquarters will be in Los Angeles.

H. E. Weihmiller has been appointed Design Engineer by Republic Aviation Corp.

Homer J. Wood has resigned as Assistant Chief Engineer in charge of Turbo-Machinery for AiResearch Manufacturing Co.

Douglas Knowles has joined Continental Aviation & Engineering Corp., as assistant manager of the company's Turbine Division. Mr. R. M. Russell is general manager of the Division.

Alexander G. Hardy recently was elected Assistant Vice President of National Air Lines.

John E. Drake has been named Chief Engineer of Century Controls Corp. He will be in charge of development of accessory control systems for aircraft.

Robert A. Wagner was appointed Chief Engineer for Hiller Helicopters. He was formerly associated with McCulloch Motors.

T. H. McClain, of the Preliminary Design Division of Lockheed, has taken an extended leave of absence to act as President of the Aircraft Chapter of Engineers and Architects Association.

Thomas G. Lanphier, Jr., vice president and assistant to the president of Consolidated Vultee Aircraft Corp., was elected president of the National Aeronautics Association at its recent annual meeting.

Walter Binaghi has been reappointed Chairman of the International Civil Aviation Organization's Air Navigation Commission. Appointed by the ICAO Council to serve as members of the Commission were **Major Jose C. M. Correa,** of Brazil; **H. A. L. Pattison,** of Canada; **Claude Teyssier,** of France; **J. van der Heijden,** of Netherlands; **Major Fermin T. Calbeton,** of Spain; **E. Ljung,** of Sweden; **D. F. Peel,** of United Kingdom; and **P. DeForrest McKeel,** of the U. S. Secretary of the Commission is **A/V/M Alan Ferrier,** ICAO Assistant Secretary General for Air Navigation.

Walter J. Currie has been appointed assistant manager of Lockheed Aircraft Service-International Administration Dept.

Jordan E. Johnson, associated with Vickers, Inc. for 12 years, has been named Aircraft Application Sales Engineer for the Mid-Atlantic area.

J. D. Meyer has been appointed Sales Manager of Landing Gear and Airframe Equipment, and **S. R. Craig** has been named Sales Manager of Fuel Metering and Engine Equipment, of the Sales Department of the Aircraft Section of Bendix Products.

Guy W. Vaughan, former Chairman of Curtiss Wright Corporation and Wright Aeronautical Corporation, has been elected a director of John Chatillon & Sons, New York, manufacturers of scales, springs and force measuring devices.

Frank McGraw recently was appointed personnel director of Pastushin Aviation Corp., Los Angeles.

Loral D. Bonham is the new chief engineer of Fletcher Aviation Corp., Pasadena, Calif.

William P. Youngs has been appointed vice president-sales of Aircraft Supplies, Nutley, N. J.

Convair's **Fred E. Chambers** was elevated to the managership of industrial relations and security at Convair's Fort Worth division. **Max G. Burland,** whom Mr. Chambers succeeds, was transferred to a position in the corporate general offices in San Diego, Cal. **Mr. James L. Budros** takes over Mr. Chambers' former position as personnel manager, and **E. L. Clerc** has become supervisor of labor relations at Fort Worth.

J. D. Strickland recently was appointed sales manager-aircraft operations for Pacific Airmotive Corporation.

COMPANIES

Lockheed Aircraft Corp., Burbank, Calif., is conducting a preliminary design study on nuclear-powered aircraft under a contract with the Air Force.

Eastern Air Lines has contracted with Shell Oil Company for delivery of an estimated $35,000,000 worth of aviation gasoline. This represents delivery of a major part of the grade 100 and 115 aviation fuel required by EAL's current fleet of 105 aircraft.

General Electric Co. is completing plans to build a $1.8 million combustion laboratory in Schenectady, N. Y., to aid scientists in obtaining knowledge needed to produce more powerful gas turbines for aircraft and other applications. Completion of the lab is scheduled for late '54.

AIRWORK Corp. has been appointed distributor for Pacific Division of Bendix.

Ryan Aeronautical has been awarded a contract for approximately $1,000,000 worth of major components for GE J-47 jet engines.

Beech Aircraft has announced that an initial purchase of Beechcraft *Mentor* military trainers has been made by the Air Force of the Republic of Colombia. The

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first of a series of *Mentors* for foreign delivery are off the production lines and are ready for delivery to the Chilean Air Force.

Air France, Inc. has become an associate participant of Air Cargo, Inc. Trans-Canada was the first foreign carrier to join Air Cargo; Air France, the second.

Braniff Air Lines has selected Hardman series 3027-M high-density luxury seats for the three DC-6's which are being added to its fleet.

Lufthansa, the new German airlines, has signed a contract with Convair for the purchase of four Convair-Liner 340 transports.

Thompson Products, Inc., Cleveland, has purchased Bell Sound Systems, of Columbus.

KLM Royal Dutch Airlines won the handicap section of the London-Christchurch International Air Race. KLM covered the 12,500-mile route in a DC-6A *Liftmaster* in 49 hours, 57 minutes, 13 seconds, winning a first prize of $28,000. The DC-6A was captained by H. A. A. Kooper. Second prize in the race went to British European Airways flying a *Viscount*. The third plane in the race, a New Zealand Air Force *Hastings*, was disqualified by engine trouble.

Columbia University and the **Daniel and Florence Guggenheim Foundation** jointly announced the establishment of a new educational and research unit at Columbia. It will serve as a national center for the study of air flight structures, particularly in the supersonic range. The Daniel and Florence Guggenheim Foundation has provided a grant of $329,000 to establish the new center.

Gray Manufacturing Co. has been awarded a contract in excess of $3,000,000 for electronic equipment, by the Bureau of Aeronautics, U. S. Navy.

National Airlines has ordered three 10-passenger Sikorsky S-55 transport helicopters for local service use in congested areas served by NAL.

Scandinavian Airlines has signed an interline agreement with New York Airways which makes SAS the first foreign airline to offer its passengers helicopter taxi service between New York International Airport, LaGuardia and Newark Airports.

Mitchell Mobilhangar Corp. has moved to larger quarters at 150 East 39th Street, New York, from 509 Fifth Avenue. **John L. Mitchell** is president of the corporation; **L. Gillespie Erskine** is executive vice president; **Walter S. Stanley** is vice president in charge of sales; and **John B. Patten** is the sales manager.

The **M. J. Johnson Aircraft Engineering Co.** will occupy a new plant being built at the Schuylkill Airport, Pottsville, Pennsylvania. The Johnson Co. manufactures cockpit control equipment for all types of aircraft.

Thompson Products, Inc. has been awarded a Navy contract to build and operate a jet engine test facility on the Lake Erie shore at Perry, Ohio.

Pratt & Whitney Aircraft has added a 50-ton metal altitude chamber to its jet-testing equipment at Andrew Willgoos Turbine Laboratory.

Aeronautical Services Inc. and the new firm of **Weems and Plath, Inc.** have opened new offices at 229 Prince George St., Annapolis, Md. They formerly were located in Washington, D.C.

AiResearch Manufacturing Co. has sold TWA 13 complete aircraft pressurization systems for use in the conversion of *Constellation* transports to air coaches.

Gladden Products Corp. appointed Reciputi and Weiss, Inc. as its Eastern representative. The offices are located at 25 John St., Amityville, L.I., N.Y.

Dal-Tex Aviation, Inc. has opened a new sales office at 8512 Cedar Springs, Love Field, Dallas, Texas.

National Aeronautical Corp., of Ambler, Pa., has named Davis-Parsons, Inc. its advertising, public relations and sales promotion agency.

Flight Refueling, Inc. is planning to move from its present headquarters in Danbury, Conn. to Baltimore, Md.

Chance Vought Aircraft has begun construction of a low-speed wind tunnel for use in the company's jet aircraft and guided missile program.

AWARDS

Ralph S. Damon, president of Trans World Airlines, received the National Association of Foremen award as "National Management Man of the Year" at NAF's 30th annual convention in Milwaukee.

Harold Crary, retiring vice president of United Air Lines, was honored at a testimonial dinner given by American Airlines. Mr. Crary was presented with a silver tray inscribed by C. R. Smith, president of AA and other top American Airlines officials.

Andrew B. Shea, president of Panagra, has been awarded the Order of Merit for distinguished service. Presentation of the award, the highest Peruvian decoration given by the government to civilians, was made by President Odria of Peru.

John W. Meyers, vice president of Northrop Aircraft, received the Night Fighter Association's first special service award. It was given him for his work with the Northrop P-61 during World War II.

AERO CALENDER

Nov. 19-21—National Aviation Trades Assn. 14th annual convention. Hotel Broadview, Wichita, Kan.

Dec. 1-2—American Society of Mechanical Engineers' frequency response symposium. Hotel Statler, New York.

Dec. 4-6—Executive Air Transport Co. Seminar. Pickwick Arms Hotel, Greenwich, Conn.

Dec. 17—Seventeenth Wright Brothers Lecture, U. S. Chamber of Commerce Bldg. Washington, D. C.

Jan. 25—IAS Honors Night Dinner. Astor Hotel, New York.

Jan. 25-29—Twenty-Second Annual IAS meeting, Astor Hotel, New York.

Jan. 25-28—Plant Maintenance & Engineering Show, International Amphitheater Chicago. Conference at Hotel Conrad Hilton.

Feb. 3-5—Society of Plastics Industry Edgewater Beach Hotel, Chicago.

Apr. 29-30—American Society of Tool Engineers. Convention Center. Philadelphia

May 5-7—Third International Aviation Trade Show, sponsored by Aircraft Trade Shows, Inc. 71st Regiment Armory, New York.

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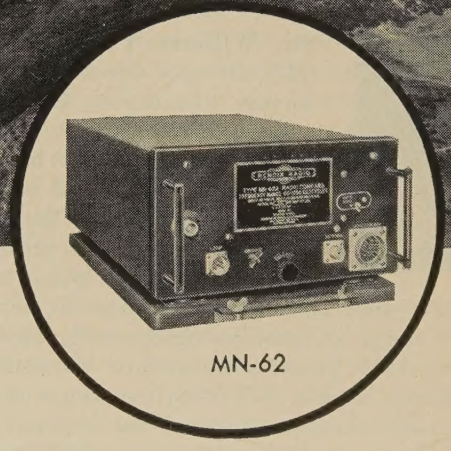

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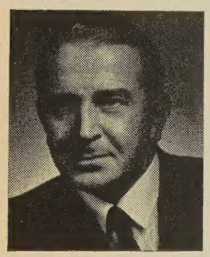
Aviation's First... and next 50 years

What important developments can the world expect in aviation in the next 10, 20 or even 50 years? Will passenger aircraft cut across the skies at 500 or 700 mph? Will rockets and guided missiles traveling at speeds between 1,500 and 3,000 mph replace today's piloted combat aircraft? Can we look forward to successful man-made satellites? In the following columns, SKYWAYS presents the thinking of recognized leaders in aviation on the shape of wings to come, plus their appraisal of developments which have contributed most to the advancement of the industry in the past 50 years.



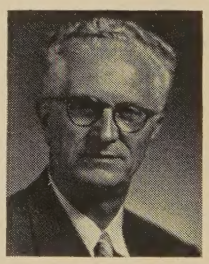
Sir William P. Hildred, *CB, OBE, Director General, Int'l. ATA.* Anyone who expects to be around aviation for some time to come takes a considerable risk if he tries to say what he thinks will be the major developments of the next 50 years. It is almost as great a risk as that involved in trying to single out from the many milestones of the first 50 years those five or 10 which he considers the most significant.

The remarkable progress of aviation—from the cloth, wood and wire models of 1904 to the major weapon of war, the great instrument of peace, the employer of millions and the worldwide public utility of 1954—has all taken place within the life span of personal friends still active in it. And its development has been so rapid and so frequently astounding that almost anything can happen in the future.

In a sense, however, one question answers the other if one considers, not the aircraft, but the uses to which it is put. I would hate to say whether the most significant events of the last half century were the dropping of the first bomb or the lifting of the first passenger, the longest fighter flight or the linking of Europe and America by transport aircraft. But I have no hesitation in saying that in the balance of 50 years, man's good instincts as expressed in aviation have managed to keep an upper hand over his destructive ones and that this balance, precarious though it may seem at times, is the best augury for the next 50 years.

Anyone making predictions at long range must decide whether he is an optimist or a pessimist. If he is a pessimist, he will either refuse to predict or say flatly that the question is academic because in that time there will be no world, no aviation, no life. If he is an optimist, he may admit that there may be perilous times ahead when the beast in us threatens to overwhelm the best in us, but he will be confident on the basis of past performance that it will all come out right in the end.

I am, by nature and conviction, an optimist. Therefore, I am certain that the next 50 years will see the development of new sources of power and new kinds of material which will make aviation really economical, new systems of navigation which will make it completely reliable. I am not being detailed because I also believe that the next 50 years will see new discoveries in the sciences which will change the basis of aeronautical development and simplify the aircraft, the powerplant and the methods of their control and use. Over and above these materialistic developments, I believe that they will come into the use of a better and more moral world community than the one we know today. And when—mark, I do not say *if*,—this occurs, it will be due, at least in part, to aviation's services to the peaceful community of the scholar, the statesman, the tourist, and the businessman. Perhaps, when someone looks back from the vantage point of AD 2004, he may decide that this was aviation's greatest development in its first century.



Dr. T. P. Wright, *Pres., Cornell Aeronautical Lab.* Several executive types of aircraft of modern vintage are so clean aerodynamically—as shown by their low drag coefficients, and so efficient structurally—as indicated by high ratio of useful loads to gross weights, that they can fly at 150 mph carrying 1,000 lbs. useful load with the expenditure of just under 100 horsepower. Fifty years ago the design of aircraft, as exemplified by the Wrights' "Flyer", was such that in order to fly a scaled-up model at the above speed and with the load indicated, would require an engine giving just under 7,000 hp!

What are the principal developments that have brought about this tremendous improvement? The advances were both by evolution—many small refinements, and revolution—a few large innovations.

1. First on my list will be the former, evolution. I pay tribute to the many engineers and designers who, through the intervening years, have made small but important contributions to greater efficiency of airplane and engine design. Included would be refinements in structural analysis and design, a general fairing-up of

Opinions indicate next half century will see transports flying 100,000,000,000 passenger-miles a year at speeds between 500-700 mph; helicopters flying all short-haul routes; nuclear-powered military aircraft flying at Mach 2

aircraft by elimination of unnecessary items of drag, and improvements in aerofoil section characteristics.

Among the most important of the large or revolutionary innovations in design, I list the following which are roughly in order of importance and cover the whole range of aviation development:

2. The gas turbine engine—making practicable flight at supersonic speeds.

3. The controllable-pitch propeller—making it possible to achieve a great increase in speed range, with accompanying safety.

4. High-lift devices, including slots and flaps of many configurations—contributing substantially to increase in speed range.

5. The NACA cowl—contributing greatly to drag reduction of radial air-cooled engine installations.

6. Electronic aids to air navigation and instrument landing, on which our present common airways system is based, including ILS, VOR, Radar (surveillance and GCA) and soon DME with computer for parallel-course flight—making possible safe and regular air transportation.

7. Aluminimum alloy development—supplying a material of great efficiency for aircraft construction and making possible the internally braced monoplane configuration.

8. The Magnaflux process for crack detection—contributing greatly to reliability of powerplants and thereby to improvements in aviation safety.

9. 100 Octane fuel—making possible greater output of engines.

10. Landing gear development, particularly retraction (but including the tricycle arrangement, castering and brakes)—reducing drag and permitting greater safety for take-off and landing.

A forecast of aviation development in the future involves many difficulties, and if made for a period of time of more than 20 years or so, is little more than a guess. However, I will list some objectives that I feel will be achieved in the next 20 or 25 years.

First, however, a word on my concept of where we stand on the classical growth curve. Advancement up to 1925 was slow, but accelerating during the latter part of that period. From then until the present, gains have been substantial, progressing up the steep straight part of the growth curve. The progress will continue on this straight portion for another 10 years, and then will reach the tapering off part of the curve, with considerably reduced rate of improvement thereafter. This all applies to aircraft development and to air transportation.

Below are given some important directions in which I anticipate great improvements:

1. *The helicopter.* Because of the characteristic ability to rise and descend vertically possessed by the helicopter, types will be developed that are suitable for extensive use on local-service airlines as well as for many other phases of aviation. I anticipate extension to successful achievement of the Convertiplane; and with this type available, other areas of use will surely be exploited.
2. *The gas turbine engine.* Further research and development will reduce specific fuel consumptions now achieved by the order of 25%.
3. *The nuclear energy source for aeronautical power plants.* We may confidently expect development and use of the nuclear powerplant toward the end of the period of this forecast.
4. *The by-pass engine.* This special configuration of the gas turbine powerplant will be developed for use in both civil and military aircraft, to supplement the turbojet and turboprop arrangements, in order to achieve greater over-all efficiency for certain flight regimes.
5. *Boundary layer control.* I believe practicable designs exploiting the boundary layer control concept will be produced and will achieve importance as a means of extending aircraft speed range.
6. *Speed.* Aircraft with speeds of 1,000 mph will be available for certain air transport and of 1500 mph for military use. I do not feel that flight at speeds exceeding Mach 2 (1500 mph) will be achieved in man-carrying aircraft for extensive service during the period of this forecast, due to the extreme difficulties of overcoming the numerous troubles caused by aserodynamic heating.
7. *Gust alleviation.* Success will be achieved in introducing gust alleviation devices in aircraft to the great comfort of the passengers as well as to the benefit of the aircraft structure. Fatigue life of the structure will be extended due to this.
8. *Noise.* I anticipate the development of practicable means for noise reduction to an acceptable level for persons on the ground as well as in the air.
9. *Safety.* The commendable progress in safety through accident prevention will continue, augmented by improved procedures developed from operational research studies to supplement detail design improvements. More attention will be paid to features designed to assure passenger and crew survival in non-preventable accidents.

10. *Air transportation.* Air transportation will continue to expand for another 10 years along the rate curve of the past 20 years and more slowly thereafter. Similar expansion in non-transport aviation may be expected. However, for anything like the attainment of the potential for personal flying, a markedly improved utilization must be realized. This will in part be by the development of a combination of road and air vehicle.

Hall L. Hibbard, *Vice Pres., Lockheed Aircraft.* Aviation in its second 50 years—that will be 2003 A.D.—will be hard pressed to forge bigger miracles than in its first half-century. Powered flight itself should have been miracle enough to last several generations. But, in his usual unwillingness to be content with limitations, man is on the way to wonderful new excitement and utility with tomorrow's airplanes.

All the 50-year possibilities of aviation are prohibitively complex to predict now. Necessarily embracing space flying, today's prophecies may prove far short or ridiculously extreme. They hinge on future progress in aviation sciences in which present knowledge is but a scratch on the surface. Nuclear physics, aircraft metallurgy, aeromedicine, electronics, the chemistry of fuels and nearly all sciences in the new world of superspeed are barely on the threshold of a vast realm of information on which the shape of airmen's plans and planes will be based.

One certain development is the jet-powered family airplane that can rise and descend vertically. This type can also take the form of a feeder or executive transport. Its speed can easily be 500 mph. It will make every backyard and rooftop a potential airport. The busy executive with a vertiplane can fly off his factory roof to a destination 500 miles away in the time he now takes to drive to the airport.

Think how a jet runabout flying on automatic navigation devices could end man's need to live close to work. Convenient commuting up to 300 miles will reshape our cities.

Verticle risers are mass-producible at practical prices, when engines with adequate power become available not too many years from now.

Long-range commercial transports may still look relatively normal, except that they will travel at Mach 2 when we have more powerful engines—always the key to air progress. Atomic powerplants for commercial transports are definitely possible.

Airliners will fly trans-polar routes routinely, but their general route patterns will stay the same. Fares, cut in half, will stimulate travel and lead to improved international understanding.

In technical matters, one major development to increase speed will be wings incorporating boundary layer control. Wings will have apertures or channels through which boundary-layer air or engine air is channeled and emitted, to offset present flow breakdown due to boundary layer build-up.

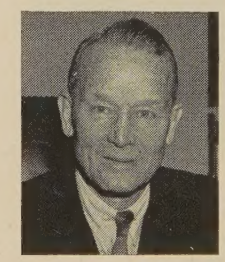
Discoveries in guidance equipment, as developed for military missiles, will have commercial importance. Look for missiles to carry mail and super-express across the country at Mach 5, or maybe even Mach 10, with ramjet engines. Requiring no human pilot, they can provide transcontinental desk-to-desk deliveries in three hours or possibly four.

Early in the next 50 years, missiles take over most fighter-plane roles. Then missiles will obsolete the long-range bomber. Missiles will not rule out the atomic-powered "bomber," the one with multiple round-the-world range, however. Such craft could be mother-ships for special-purpose fighters, aerial missile bases or reconnaissance ships.

Despite the complexities involved, space flight cannot be ignored. First may come the satellite-type space vehicle—then flights around the Moon and back to Earth. Perhaps—who knows?—there may be attempts to land on the Moon before the century bows out.

My choice of the 10 foremost fields of aviation development since 1903 are:

1) Contributions of powerplant producers to provide light, reliable engines.
2) Development of high-efficiency, routine maintenance methods by airlines and the military, to keep airplanes in the air a maximum number of hours.
3) Development of high-strength, high-temperature, lightweight materials.
4) Development of wind-tunnel research techniques.
5) Development of the turbine engine.
6) Development of pilot aids permitting round-the-clock flying with such features as pressurization, instrumentation, simplified controls, ice control, multi-engine safety.
7) Mechanical devices such as power-operated controls and high-lift apparatus to make flying faster and more economical.
8) Electronic navigation aids.
9) Research knowledge gained from supersonic experimentation, providing data which opened new avenues of aviation progress.
10) Broadening of the fund of knowledge of the atmosphere.



Admiral E. S. Land, *USN (Ret.), Pres., ATA.* The year 1953—during which the aviation industry is celebrating the Golden Anniversary of powered, controlled flight—will see the scheduled airlines of the United States pass the 30-million mark in the number of passengers carried. This forecast is based on the passenger traffic figures for the first nine months of 1953, which total approximately 23½ million passengers or more than 18% above the number of passengers flown during the same period in 1952.

The invasion of the transportation field by air has been greatly aided by two factors:

1) The rapid technological advances in the aircraft itself *i.e.* the powerplant and body frame.
2) The remarkable development of electronic devices to control aircraft in flight.

As president of the Air Transport Association, which represents Scheduled Domestic and International Air-

lines of the United States, I have seen the scheduled airlines grow into a billion-dollar industry. I have watched the scheduled airlines replace their World War II fleets—DC-3's and DC-4's (C-47's and C-54's in their wartime garb)—with new and improved equipment—*Constellations*, DC-6's, Convairs and Martins.

Moreover, today there are signs that within a few years a new modernized fleet will be operating over the airways, a fleet composed of turbine-powered conventional and helicopter-type aircraft.

Within the next two decades I believe passenger jet-transport planes will fly transcontinentally at clock-stopping speeds. Such planes will leave New York at noon and arrive in Los Angeles at noon.

Helicopters made great advancements during the Korean War and it is predicted that within less than a decade twin-engined 50-passenger rotary-wing aircraft will be covering many of our routes for distances under 300 miles. At the present time the Air Transport Association Committee on Rotocraft is working on the details of a proposed program, in which multi-engine helicopters will fly in scheduled around-the-clock operation.

Due to energetic pioneering work in the electronic field, greatly accentuated during World War II, scheduled air transportation is approaching its goal of all-weather schedules. In addition development of electronic aids to air navigation has made possible a great increase in the traffic-handling capacity of airports. Backed by a combination of governmental and civilian organizations, electronic devices are continuing to improve. The time is coming when pilots will be present in an aircraft mainly to monitor automatic equipment. In effect the equipment will fly the aircraft. It will take a plane off the airport, fly it in its proper position at the desired speed, with due consideration for all other airborne traffic, and land it safely, smoothly and without delay at the airport of destination, even in zero weather. However, I do not predict the disappearance of the pilot. There must be men not only to monitor the automatic equipment, but also to take over manual control if it becomes necessary. There is no substitute for human judgement.

The next decade will see the scheduled airlines carrying more than 60,000,000 passengers or more than twice the record-setting figure of 1952. At that time scheduled air transports will be flying 5,000,000 miles daily, compared with the 2,000,000 miles per day they flew in 1952.

Lieut. Gen. Donald L. Putt, *Cmdr., ARDC, USAF.* The extent of air progress in the next 50 years naturally depends on many divergent factors—political, sociological and economical primarily. With such factors in support of air research and development activities, it is possible to foresee certain air progress trends, though by the nature of our work in Air Force research and development we cannot predict exactly where we are going.

First, atomic energy is going to have an increasing effect on air power's many aspects. We have only seen the beginning of the miracles of the air-atomic age.

Second, speeds many times that of sound will be achieved by military air vehicles as part of progress in supersonic flight.

Third, air weapons and miscellaneous flight equipment will continue to become more and more automatic in operation through the use of electronics, sonic, infrared, and other techniques.

Four, weapons systems, not just weapons, will govern more forcefully the thinking and action of military men.

Five, pilotless aircraft will supplement on an increasing scale manned military aircraft, especially as automatic devices for navigation and final control to the target are improved.

Six, continual refinement of transistors will make electronic gear for aircraft much improved.

Seven, guided aircraft rockets will become standard armament for interceptor aircraft.

Eight, air-defense systems will grow in automaticity.

Nine, turboprop engine development indicates that cargo aircraft capable of carrying 100,000 to 150,000 pounds are possible, enabling operations as transocean freighters.

Ten, convertiplanes should appear as result of ramjet and pulse jet progress, making possible direct air deliveries from manufacturer to large transports at air terminals outside city limits. Air passenger travel would be improved as convertiplanes could similarly service large transports at outlying airports.

Eleven, applications of boundary layer control should result in slower stalling speeds and slower take-off speeds. This control also reduces friction drag, making it possible for high-performance aircraft to fly at greater supersonic speeds for long periods of time with less fuel.

Twelve, satellite vehicle development could possibly profit from application of nuclear propulsion to airborne vehicles, as the weight-of-fuel problem would be solved and range would be practically limitless.

The challenge of flight spurred early air pioneers to overcome the first problems facing manned flight and their successors in succeeding generations to achieve the tremendous advances of aviation during the first 50 years of powered flight. It is this same challenge of flight which will continue to spur mankind to overcome obstacles facing continued air progress during the next 50 years.

The 10 developments which I believe contributed most to the advancement of aviation in its first 50 years are listed below in order of importance:

1) *Lightweight metal alloys*—without these aircraft never could have become as large and practical as they are today.

2) *Air-cooled engines*—these gave aviation engines much greater power at reduced weights.

3) *Jet engines*—these provided a new type of powerplant for supersonic speeds.

4) *Handley-Paige slot*—this was the first solution to the problem of slower stalling speeds.

5) *Flaps*—this development provided safer flight by lowering landing and take-off speeds.

6) *High-precision gyros*—these were basic to instrument flying, autopilots and guidance.

7) *Radar*—it allowed for all-weather flying.

8) *Lightweight, high-capacity sub-systems*—these brought about accessory power systems, retractable landing gear and related improvements.

9) *Controllable pitch pro-* *(Continued on page 30)*

by Franklin D. Walker

BUSINESS FLYING 1905–1953

Today's fleet of over 10,000 aircraft used for business had its beginning 48 years ago with a 41-foot dirigible powered by a 5-hp engine

One of the major attractions at the Lewis & Clarke Exposition in September, 1905, was a dirigible equipped with a disk propeller driven by a sputtering 5-hp engine. Its "swallow-like" flights proved that an airship could "sail to all points of the compass and up and down as well," according to one newspaper of that day.

The ability of the 41-foot airship to follow a compass course with any degree of accuracy was highly questionable, but its performance did prove something else. It demonstrated that an air vehicle could be adapted to useful work in the realm of business.

For history records that the little dirigible, built by George Tomlinson in Syracuse, was financed by a business man, Charles B. Knox of Johnstown, N. Y., to advertise his product, gelatine. Hundreds of thousands of people became aware of that product as the dirigible "Gelatine" toured the nation, with Lincoln Beachey at the controls, for many months after the Lewis & Clarke Exposition.

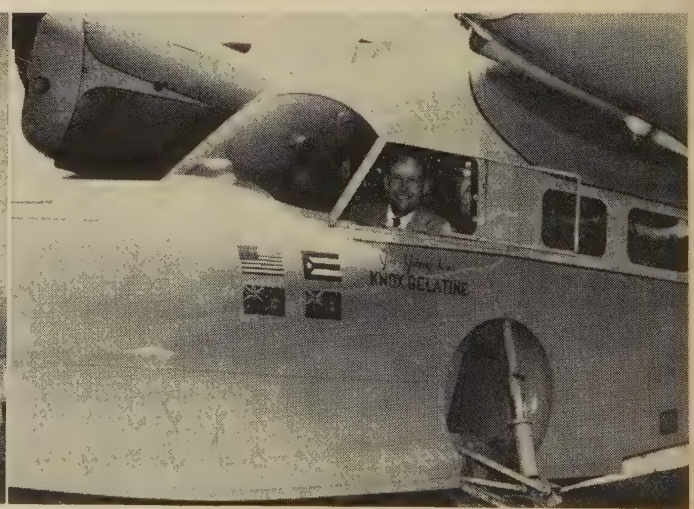
Whether Charles Knox was the first business man to utilize an air vehicle as a tool in his business is difficult to determine, because no historian has ever delved into that phase of aviation development. But the records do show that less than 18 months after the Wright Brothers made their first successful flight in a heavier-than-air craft, Knox had commissioned Tomlinson to build an airship, paint the word, gelatine, on it in large legible letters and fly it wherever large numbers of potential customers assembled. So let's call Knox a pioneer in the use of the air for business promotion.

Interest in airships waned as the Wrights worked to perfect their early powered kites and as such other pioneers as Glenn Curtiss, Glenn L. Martin, Louis Breguet and Louis Bleriot made contributions to the art of heavier-than-air craft. And the use of airplanes for any business purpose was spotty. The period 1905 to 1915 was the era of the dare-devil birdmen who flew for the love of flying but at the same time developed flying skills so necessary to the advancement of the new method of transportation. The unreliability of powerplants was a major factor in aviation's slow progress in that period.

Business use of airplanes became more general in the 1920's, when enterprising operators bought surplus war-

1905—*Charles B. Knox used this airship to advertise his product, gelatine. It toured the U.S. with Lincoln Beachey at the controls*

1953—*Today, the Charles B. Knox Company plane is Grumman Widgeon (G-44A) piloted by John Knox, grandson of founder*



time aircraft and established charter services, but few companies actually purchased airplanes for daily usage. It was not until the 1930's, after Lindbergh's 1927 hop to Paris served to point up the reliability of the airplane, that business flying as we know it today began to spurt forward.

A few companies had demonstrated in the 1920's that the airplane was highly useful in shuttling executives to distant points (in good weather) for dealer and distributor conferences, for contact with suppliers and for interplant liaison, but it was still pretty much of a novelty. Lindbergh's flight cast a new light on airplane utility.

Among the first business operators to embrace the airplane as a useful tool were the oil companies. Notable examples were Shell, whose pilot was Jimmy Doolittle, and the Texas Company, for whom J. D. (Duke) Jernigan was the pilot.

In 1931, the Walgreen Drug Stores operated a Sikorsky flying boat as part of its transportation system. And in 1933 M. L. Arnold, Wichita (Kan.) De Soto-Plymouth dealer, bought an airplane to visit prospects and to keep in closer touch with the factory in Detroit. A Waco enabled G. H. Jackson, executive of the Modine Manufacturing Company of Racine, Wis., to display his Ice-Fan, a portable ice-filled room-cooling unit, to prospective customers in the west and south of the Mason-Dixon line.

Many companies owned more than one airplane. For example, Prest-O-Lite operated a Lockheed *Vega* and a Mahoney-Ryan B-5 as aids in selling storage batteries. The *Detroit News* had an autogiro and a Waco in 1932 and is still using aircraft for its executives and editorial department.

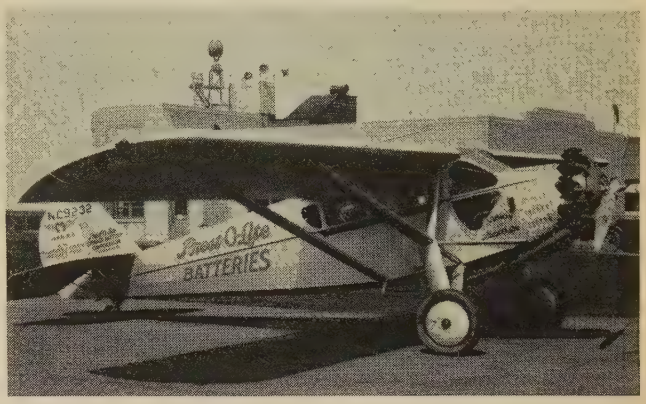
Sales of aircraft to business jumped forward steadily in the 1930's, as newspapers and magazines published articles concerned with how some company saved time and money through aerial transportation. One such story in 1937 was a glowing report of the advantages of the airplane to 30 Canadian mining companies.

Typical of their operations was the experience of one company, which used a plane to carry radium-bearing ore from Great Bear Lake to Waterways in Alberta, Canada. The distance was 1,000 miles. The Canadian companies flew a Wright *Whirlwind*-powered Bellanca, a Fairchild 82 powered by a P&W 520-hp *Wasp*, a 120-hp Gypsy Moth, and a Noorduyne with a 420-hp Wright engine. A gold dredging company in Canada had the largest airplane, a Junkers G-31 trimotor using 600-hp P&W engines. Other aircraft pressed into service by mining operators in the middle 1930's included Beechcraft, Stinson, Curtiss *Condor*, Fairchild F-24, Waco F-2, and Grumman.

It was in the 1930's that the corporate fleets began to appear. Phillips Petroleum Company in 1936 was flying a Lockheed *Orion*, a Lockheed *Vega*, a Travelair, two Lambert-powered Cavaliers, and a twin-engine Boeing 247D. The company later added a Fleetwings amphibian.

Business was rapidly learning that there were sound economic reasons for business ownership of aircraft, in addition to the convenience of being able to start a trip at any time of day rather than to adjust to a rail or airline schedule. And it was soon realized that the arrival of a company executive by air carried with it a certain prestige unobtainable with surface transportation.

Among other companies whose executives quickly sensed the advantages of the airplane in the 30's and took to the air were Esso, Cities Service, Texaco, Shell, Gulf, Pure Oil, Phillips Petroleum, Palm Beach Suits, La Touraine Coffee, Beer Hop Gold, Consolidated Lobster Co., Finch Telecommunications, Flying Billboard, Hal Roach Studios, Horlicks Malted Milk, New York *Journal-American*, Firestone, (*Continued on page 38*)



RYAN B-5 *was one of the early airplanes operated for business. This one helped sell storage batteries for the Prest-O-Lite Corp.*

WACO *enabled G. H. Jackson (above), an executive of Modine Mfg., Co., to display his Ice-Fan, a portable room-cooling unit*

TRAVELAIR, *a single-engine monoplane, was flown by La Touraine Coffee in early '30's when business flying began to increase*

Survival Considerations for High-Altitude

Jet transport designers must provide extra margin of safety in structure and equipment, as protection in case of pressure blowout

In the interest of economy and range the new jet transports now on the drawing boards and which are ultimately destined for use on the world's commercial airways, must be able to operate for prolonged periods at altitudes from 40,000 to 50,000 feet. Acceptance of these new transports by the operators and the traveling public alike will require the designers to provide features which insure the safe return of all occupants, in spite of reasonable mechanical malfunction or pressure blowouts.

Problems associated with this concept are particularly challenging since physiological considerations are more critical at 30,000- to 50,000-foot levels than at today's general level of operation of 18,000 to 25,000 feet. For example, at 45,000 feet useful consciousness can be as short as 25 seconds after exposure.

For general consideration of survival, particular attention will have to be given to fail-proof pressure retaining structures, to systems and devices which will protect the occupants of the aircraft until fully inhabitable altitudes are reached, and to providing the aircraft with means to descend at high emergency rates to minimize exposure time at altitude. It is only the very high altitudes which are of concern. While the problem of attaining complete passenger protection may seem formidable, indications are that reasonable means will be found to provide the required protection by the time the jet transports are available for use.

LATE MODEL *Constellations in operation by Trans World Airlines employ double cabin windows as extra passenger protection*

Behind us are hundreds of thousands of flight hours with pressurized aircraft with little structural difficulty. Therefore, the structural problem except for sealing difficulties should not be too hard to solve. It will be advisable, however, to provide insurance in the form of extra margins of safety even though this involves some weight penalty.

Specifically, with respect to structural considerations, the high-altitude transport's entire pressure envelope must be designed to preclude structural failure from pressure load under any combination of flight loads obtainable in routine or emergency flight operations. This involves not only careful and exacting considerations to the primary structural components but to the detail design as well.

Once the designer has created a structural configuration which he believes will not fail from pressure loads throughout the life of the vehicle, then he should turn around and assume that single failures will occur, and protect against this contingency as well. Although this may be considered by some to be an extremely conservative approach, it is recommended on the basis that the impossible can and does occasionally happen. Since the results of such failures can be much more severe than similar experiences with contemporary piston-engine powered aircraft, more than the usual design emphasis will be in order.

If this sounds too severe, one should recall that new American transports already have double cabin windows installed, either one of which can fail without danger of blowing occupants out of the aircraft. This philosophy should be extended in the jet transports to include not only consideration of occupant removal but also complete retention of pressure after the outer window has blown, remote as this possibility may be. This probably calls for independent framing, which incidentally is now incorporated in TWA's newer model

Transports

by R. W. Rummel
Chief Engineer, TWA

MARTIN 404 *also features double cabin windows. Independent framing of the windows is incorporated in both the Martin 404 and late model Constellations flown by TWA*

Constellations and Martin 404's even though, relatively speaking, these are low-altitude aircraft. In the jets each of the double windows should be designed to carry the full pressure differential obtainable plus reasonable and necessary margins of safety, considering variations in material properties and the ravages of attrition during acceptable replacement periods.

To be consistent and proper, the double window philosophy should be extended to all windows, no matter how large or small, including cockpit enclosures. Here the weight penalty will be rather large, probably on the order of 500 to 600 pounds. This, however, is the one area of the airplane which must be protected at all costs, for if the crew should become incapacitated, all on board would be placed in serious circumstances.

With respect to the view that single-pane windows designed to the same weight as double windows plus double framing will have such tremendous margins that failure will not occur, we must remember that well-designed single-pane windows have failed in the past. Several instances of windows failing from fatigue arising from relatively minor nicks indicates that strength considerations alone relative to the pressure loads are not always adequate.

As far as the fuselage shell is concerned, it would be inappropriate to suggest the double-structure approach to designing the pressure envelope because of the resulting complexities and weight penalties, coupled with considerations of the excellent mechanical properties of aluminum alloys proven to be satisfactory in long-term use. In this instance it would seem far better to add extra margin to a simple basic structure. The recent suggestion that the manufacturers should seek a solution to the "peel back" problem, that is, to create a design which will better arrest the progressive nature of some structural blowouts, is certainly meritorious and it is hoped that the manufacturers will respond with adequate solutions to this problem.

Suggestions are made from time to time that high-altitude transports be built like submarines, *i.e.*, with a number of separate compartments, each one a complete pressure vessel capable of isolation from the other compartments by pressure bulkheads and pressure doors. It seems to me it would be better to avoid this design completely, and to include a portion of the weight involved in such a design concept in the primary structural envelope to further insure against pressure loss and better protect the whole, at the same time not restricting passenger and crew movement.

Door design may be one of the more controversial items. If pressure differentials are from 10 to 11 pounds per square inch, which we are almost sure to obtain, the average-size passenger door will have to retain a load of about nine tons. Minimum design margins would raise the design load to at least 12 tons, not considering fitting factors or other special considerations. An improved sense of security would probably prevail if doors carrying heavy loads of this magnitude would seal outward and be designed to transmit the pressure load more or less evenly to the airframe around the periphery of the door. If doors must be made to open outward, then to be consistent with the philosophy that all doors and apertures must be designed to retain pressure after single failures, one should suggest that such aircraft be equipped, even though the weight aspects would not be palatable, with inward-opening doors as well. These could be designed to carry the full pressure differential but perhaps with less margin that the outer doors which would normally carry the pressure loads. In the interest of emergency egress, an assigned crew function could be to always have the inner doors open below 10,000-foot airplane elevations.

It may be discouraging to the designer to say the pressure envelope must be designed so it cannot fail, that even after single failures of all apertures, pressure must be retained, and then to say also that occupants must be protected after loss of pressurization. This, however, must be done in view of the physiological limitations to safeguard crew and occupants in the event of pressurization-system failure and also in the remote event of fires at altitude.

With respect to failure of the pressurization system, since it is not the intent of this article to dwell upon detailed requirements for such a system, suffice it to say that designers are certain *(Continued on page 45)*

THE AIR TRAFFIC STORY

No. 4: How to Use the Common System

With Transition Phase nearing completion and Ultimate Phase beyond dream stage, Common System is proving a versatile navigator, always on the job and accurate

Today's pilot, using the Common System, has a new brand of aeronautical chart. It's helpful in good weather but more especially "on instruments". The old charts were aerial road maps, emphasizing landmarks. The new ones are, in addition, radio guides indicating locations of radio facilities and giving pertinent data such as operating frequencies and bearing information. In fact, many pilots use maps that are exclusively radio, no landmarks. When a pilot gets caught in bad weather, his map, documented with radio-sources of information, increases in value. Men assigned to operate these radios on the ground can provide the pilot with much information and assistance.

In early days, a pilot had to be well versed in all types of navigation, pilotage, dead reckoning, and radio. There were knotty problems to solve and information was at times scarce. The Common System is a versatile navigator, always on the job and accurate.

If you are flying the Common System, one of your major interests before going on a flight is to check and adjust your electronic equipment. That done, reaching your destination is easier than before and also safer.

In preparing for flight, it is assumed that you have referred to the necessary literature for the route, including charts, *Airman's Guide*, radio facility charts, *NOTAMS*, and related material.

Your next task is to make out a flight plan. On it, you list your desired route, altitude, times to various reporting points, speed, and related facts.

File this plan in person, by 'phone, or by radio with the CAA, whence it will be transmitted to the Traffic Control Center. The Center will determine whether your desired route will conflict with other traffic and, if conflict is indicated, will make the necessary changes to provide a clear route, set up your departure time, "reserve" your altitude, and "file" this information.

Now is the time to check your equipment and set it up for the flight. An "all-radio" switch usually turns on all electronic equipment. The VHF communications radio is your most important tool. It is your link with the world outside the cockpit. Let it warm up, then call the control tower for a check on the operation of your set.

When this has been done, and assuming that you have only one VOR receiver on board, check its functioning for VOR and ILS use. This can also be checked on the ground. Listen first for the identification — either in Morse code or the newer voice recording. The voice will continually repeat "This is Allentown Omnirange", "This is Beltsville Marker", etc. If your airport is equipped with ILS, tune to its frequency and see that the red warning flags on the cross-pointer indicator disappear. The pointers should also move to a position corresponding to the location of your aircraft with respect to the glideslope and localizer course line.

If there is a VOR on or near the field, tune to its frequency and identify it. Then, rotate the Omni-Bearing Selector (OBS) until the left-right needle is centered. The bearing now shown on the Omni-Bearing Selector should be the same as the direction from your aircraft to the omni station.

Now, check your Distance Measuring Equipment (DME). Set the proper frequency and then check the distance shown against the distance from you to the station.

Since we are still checking equipment, it would be well to set up the Course Line Computer, although this will not be used until the second leg of your trip. Set its dials for the destination you have chosen, then it will be ready to use when you want it.

You are now ready to go. Retune your VOR to tower frequency and ask for taxi and take-off clearance.

Airborne and on course, your electronic brains begin to function. The first leg of the journey will be to the VOR/DME station to which you fly a homing course (see Figure 1). To do this, tune in the first VOR/DME station and turn your Omni-Bearing Selector to read 40°. Correct the heading of your aircraft, as necessary, until the vertical needle centers. The To-From Indicator should read "*To*", and your magnetic compass reading should be approximately 40°.

Now, all you have to do is to fly a heading that will keep the vertical needle centered. If it moves to the right, fly a little to the right until the needle is centered. If it moves to the left, fly a little to the left until the needle is centered.

In using VOR, always remember that as long as you keep on course, you will automatically correct for wind drift. When flying a "centered needle", you are making good a track and are automatically allowing for wind drift in your heading. For example, if the course is 40° and there is a rather strong wind from the northwest, you will find that your heading will be about 37° when the needle is centered. Another thing to remember is that VOR courses are magnetic — not true — and, con-

sequently, the pilot does not have to correct for magnetic variation.

As you proceed along your course, the DME will show the distance to the first VOR/DME station. In checking your flight chart, you will notice that this station is a checkpoint. Your arrival over the station will be indicated in two ways. First, the DME reading will reach a minimum and then start to increase. Since DME measures slant distance and not ground distance, the minimum DME reading is the altitude of your aircraft. If, for example, you are flying at an altitude of 6,000 feet, the DME minimum reading will be approximately one mile. Secondly, as you reach the station, the vertical needle of your Deviation Indicator will fluctuate several times and then resume a steady position. At the same time, the reading of your *To-From Indicator* will change from *"To"* to *"From"*.

Now it is time to call in your first position report. Check altitude and time, then pick up your microphone and call the control point for the area that you are in, identify yourself, and give them the name of the reporting point, your altitude, time over the station, your destination, and ETA at the next reporting point. The station will repeat this information and can also give you the weather for the balance of your trip.

It's all bad — heavy fog.

You are now starting on the second leg of your trip. Since your new course is 15° magnetic, readjust your Omni-Bearing Selector to read 15°. Change the heading of your aircraft until the needle centers and "fly to the needle" as before. Notice now that your *To-From* Indicator reads *"From"* since you are flying a course *away* from the station. Your map shows you that the distance between the first and second VOR/DME stations is approximately 95 miles. Consequently, you continue to navigate on the first VOR/DME until you are abeam of a point which is approximately mid-way between the stations. Your DME indicates when you have reached this midpoint. This is where the Course Line Computer comes in, for there is no VOR/DME at the destination on which to "home". Remember, in checking our equipment we set in the coordinates from a VOR/DME station off to our right. Let's check to make sure the computer is set properly. Bearing from the second VOR/DME station to destination should be 300°. It is. The distance from the station to destination should be 30 miles. That's OK. The course we wish to fly to our destination is 15°. That's OK. So, turn the computer on.

From now on, your instruments — VOR Deviation Indicator and DME — read just as though the VOR/DME station had been picked up physically and placed at your destination. Where the two lines intersect is your position.

With 15 miles to go, call the tower at your destination and request landing information.

The tower operator gives you the ceiling, visibility, wind direction and velocity, altimeter reading, the landing runway, and clearance to make an instrument approach.

While you acknowledge the clearance, the tower's VHF/ADF automatically takes a bearing on you. The tower operator notes the bearing and the time and checks his Surveillance Radar scope to see that no other aircraft are in your vicinity.

At 20 miles from the outer ILS locator, turn on your ADF, getting frequency and identification characteristics from your *Airman's Guide* and tune in the Compass Locator frequency. After getting the ADF set up, cut in the "sense" antenna to check the true bearing, and then start to home in on the outer Compass Locator.

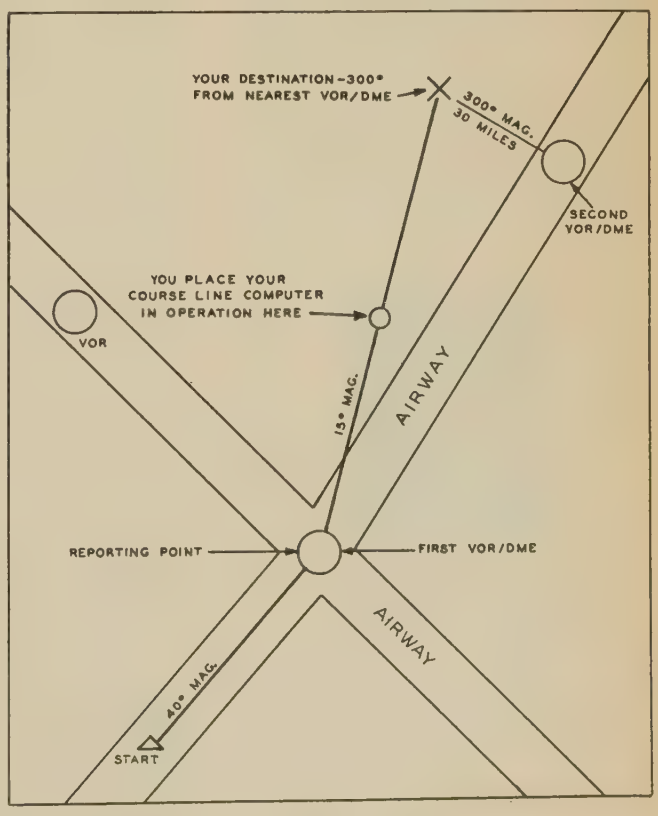
When your outer marker signals that you are over it, turn and start your approach, at the same time turning the Computer/ILS switch over to ILS position, connecting the indicator to the localizer and glideslope receivers.

It should be emphasized that a pilot making an ILS approach does not concentrate on his ILS cross-pointers to the exclusion of all other instruments. The ILS indicators simply tell him if he is on the right road. He gets to this road, and stays on it, by using his direction indicator. From the outer marker to the field, he flies his gyro-compass heading rather than chasing the ILS needles. If he is square with his compass, he finds that the cross-pointers stay on center. The pilot must never fly below the glideslope, and if he fails to "nail down" the localizer path by the middle marker, he should pull up and try again. If, at any time during the approach, the red flag, marked "OFF", appears on the face of the ILS instrument, the pilot must pull up. This means that, for some reason, the radio signals are unsatisfactory or are off the air.

At many airports, Ground Radar is tracking you throughout your approach. He is your monitor. Serious deviations from "on course" will be brought to your attention for appropriate action. The AZ (azimuth) portion of the precision scope shows your lateral course to be good, the EL (elevation) portion proves your vertical progress.

As you pass over the middle fan marker, a light blinks on your panel and your ADF swings around on the Compass Locator. You're close *(Continued on page 52)*

FIG. 1—*Diagram details VOR/DME, Course Line Computer use*



Operational Weather Problems

Flight Operations Round Table discloses need for greater use of radar, better communications to improve pilot information on weather enroute and at terminals, also more flexibility in take-off minimums

Moderator C. M. Christenson *(Dir. of Safety, United Air Lines):* "Even though we seem to know quite a bit about the weather, it's apparent from the record that we don't know enough about it to be able to consistently operate in all kinds of weather.

"This year we are celebrating the 50th Anniversary of flight, and seldom in a single generation has an industry developed to the point where it is of national and international importance. Aviation's growth can be measured by the development of an airway system that started from New York to Washington in 1918 and now covers every area of the globe.

"In the years between 1928 and 1933 instrument flight was developed in order to further our ability to meet schedules. When scheduled flying was first instituted, it became one of our major problems because it meant that a pilot flew when he had to and not when he wanted to. As a result, the pilot encountered weather conditions he would not normally have had to fly. In those early years the principal problems were those of visibility, precipitation beneath the clouds and, perhaps, high winds.

CAPT. CARL M. CHRISTENSON, Director of Safety, United Air Lines, served as Moderator. He joined United in 1933 and is credited with many notable contributions to aeronautical safety.

"By 1929 when we first developed the turn-and-bank indicator, the gyro horizon, the directional gyro and finally radio, we began to use those instruments and devices effectively and we came into much closer contact with atmospheric conditions, conditions about which we had very little knowledge at that time.

"Weather forecasting in those days was primarily for agricultural purposes. Therefore, a new method of forecasting had to be developed to enable a pilot to plan and complete his trips. Problems that had been hypothetical became real. Those problems involved electro-static discharges, turbulence, hail, sleet, icing conditions, reduced visibility . . . all the things that today are common problems to the industry.

"For the past 10 or 15 years, weather discussions have revolved principally around ceilings and visibility associated with landings. Perhaps today it would be of more value to discuss some of the other problems. Reviewing the record of 1953, you'll find that the most serious problems we've encountered have had to do with enroute types of weather involving thunderstorms, line squalls, turbulence, etc. Another problem that is becoming increasingly important is that of weather at the time of take-off and during climb, particularly as it relates to reduced visibilities, thunderstorms in the airport areas at the time of take-off, and the resulting traffic control problems.

"Undoubtedly, some day we will have equipment that will practically eliminate the problem of weather-enroute flying or even take-off and landing at the airport, but that equipment will not be available for three or perhaps as many as 10 years.

"Another very real problem is that of developing more precise information for the pilot enroute, because we are now involved in trip lengths of from eight to 15 or 17 hours, and weather forecasts that were six to 10 hours old at one time now become 15 to 24 hours old by the time the pilot reaches his terminal.

"Another question mark involves the airborne information type of equipment that will give the pilot an accurate means of navigating through and around thunderstorm and line-squall conditions.

"*In order to cover these problems today, gentlemen, and with your concurrence, let's break things down into three phases: Number 1, a discussion of the weather problems associated with take-off and climb; Number 2, the relay of weather information and forecast material to flights enroute; and Number 3, the*

PARTICIPANTS *at the Operational Weather Problems Round Table included (left to right around table) R. H. Simpson, Weather Bureau; Mel Lamb, Executive Air Transport; W. R. Strong, National Dairy Products; Al Ueltschi, Flight Safety, Inc.; Capt. Kim Scribner, Pan American Airways; John Burke, also Pan American Airways; Dave Little of American Airlines; Capt. E. D. Sager, Eastern Air Lines; Norman Huseby, also EAL; Marshall Fay, United Air Lines; Capt. Carl M. Christenson, United Air Lines; Roger M. Sullivan, CAA; and W. M. Ragland, American Airlines. Capt. Blair was not present when the photo was taken*

development of equipment designed to provide in-flight crews with more detailed weather information. Airborne radar, for example.

"With that, let's open the discussion on the first problem . . . weather problems associated with take-off and climb. May I suggest that we start with Dave Little of American Airlines."

Utilization of Radar

Dave Little *(Assistant to Dir. of Flight, American Airlines):* "No airline pilot likes to take off nor does any airline dispatcher like to have a pilot take off from a terminal in the face of a thunderstorm or be faced with the probability of having to fly through a thunderstorm condition during his climb to enroute cruise. It is our belief that the available ground radar, be it civil or military, could be more efficiently utilized if its operation were coordinated with the meteorological service to forecast probable storm movements so that terminal departures could be pre-planned to avoid potentially turbulent areas.

"A certain amount of this is done today, but it is largely through the individual initiative of well-informed and qualified control tower operators rather than a planned coordinated program of using the facilities.

"Perhaps Roger Sullivan could tell us to what extent his people use available ground radar in pre-planning the outbound clearance of aircraft from New York."

Roger M. Sullivan *(Chief Airport*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

DECEMBER 1953

Wings Club
New York, N. Y.

Round Table Participants

W. R. STRONG, known to all as "Rip," has been a pilot for National Dairy Products since 1945. He holds an ATR; has logged 10,000 hours

R. H. SIMPSON, Aviation Weather Specialist, joined the Weather Bureau in 1940 and has specialized in weather research for gov't since '47.

CAPT. E. D. SAGER is Ass't. Chief Pilot for Eastern Air Lines, the company he joined in 1939 as a copilot; prior to that, was fixed-base operator.

W. M. RAGLAND, Ass't Supervisor of Flight Dispatch, American Airlines, joined AA in 1935; has served as Flight and Chief Dispatcher.

NORMAN E. HUSEBY went to work for Eastern Air Lines in 1940 as a Meteorologist in Atlanta. Today he is Chief Meteorologist, N.Y.

CAPT. CHARLES F. BLAIR, JR., of Pan American World Airways, won Harmon Trophy in 1951. Flying since '28, he has some 20,000 hours.

MARSHALL H. FAY joined United Air Lines as Captain in 1931; became Flt. Mgr., Chicago, in 1941 and Manager, New York, in 1952.

CAPT. A. L. UELTSCHI, president and organizer of Flight Safety, Inc., is also head of Pan American World Airways' executive trans. dept.

DAVE LITTLE, Ass't to Director of Flight, American Airlines, joined American in 1939. He holds an active ATR, single- and multi-engine.

JOHN F. BURKE, Senior Atlantic Flight Dispatcher for Pan American at N.Y. International Airport, joined Pan American as Meteorologist, '42.

ROGER M. SULLIVAN has been associated with the CAA since 1941. He is Chief Airport Traffic Controller at N. Y. International Airport.

MEL LAMB, Regional Director of Executive Air Transport Co., Inc., received his ATR in 1937; became a business pilot after service with AF.

CAPT. KIM SCRIBNER, Chief Pilot-Atlantic Div., Pan American, joined PAA in '44 as copilot; became Capt. in '42, and Div. Chief Pilot in 1951.

"WEATHER BUREAU *cannot tell a pilot precisely where or whether he will encounter a thunderstorm during climb-out unless one is picked up by radar," reported R. H. Simpson*

Traffic Controller, N.Y. International Airport): "The natural tendency for a radar traffic controller is to use his radar to the fullest extent. Precipitation is one of the bugaboos in radar. Under periods of heavy precipitation, you're out of business. As a consequence, the tendency is to conduct an operation that involves vectoring or a method of control that will take aircraft around the areas of high precipitation or thunderstorm activity."

Dave Little: "More specifically, Roger, I'm wondering about this: you have ASR and PAR radar to work with, but they have limited range and limited usefulness under certain conditions of precipitation. We all know that the N.Y. area is not only blanketed but is saturated by ground radar utilized by the military. Has there been any procedure established by which this better radar could be brought into play in this picture?"

Roger M. Sullivan: "Considerable thought has been given to a possible expansion of radar service to include utilization of this equipment by the Air Route Traffic Control Center. This would give better radar coverage and would include the areas of heavy precipitation so that aircraft could be effectively vectored around the areas of high turbulence."

Dave Little: "Let's take an example. Normally, N.Y. to Chicago nonstop traffic westbound is today routed over Wilkes-Barre, Bradford, Erie, Detroit and then on to Chicago. Let's say that under a particular meteorological condition, the Scranton Valley in the vicinity of Wilkes-Barre is plugged up with thunderstorms. Now your radar doesn't look that far, but the military radar does. Is there any procedure coming into use by which the higher powered radar in the N.Y. area will be used to determine an hour or two in advance that it's not a good idea to send Chicago traffic that way; instead, we'll send it over Allentown?"

Roger M. Sullivan: "So far as I know, coordination is being effected with the military to utilize some of this Air Defense radar to at least a limited degree. This would include an arrangement whereby the N.Y. Center would obtain information from an Air Defense Center in reference to thunderstorm activity, if so requested by an aircraft."

C. M. Christenson: *"We now have on the table the problem of thunderstorms at terminals and on climb-outs. Kim Scribner, would you give us your thoughts on this take-off weather problem?"*

Capt. Kim Scribner *(Chief Pilot, Pan American World Airways):* "In addition to thunderstorms at terminals, there also exists the problem and hazard of aircraft operating under marginal VFR conditions. Although this is not as extreme as the thunderstorm condition you mention, we must find some way to handle the current exposure to collision that we have with aircraft operating into and out of airports under marginal visibility conditions.

"I think we'll have to rely upon the Captain's responsibility as an accredited weather observer. In other words, if we're going to rely on a pilot to observe weather after his take-off so that those taking off after him will have the use of his observations, then to be consistent we should rest that same responsibility on the pilots of inbound traffic . . . and that brings up the controversial subject of 'look-see approaches,' wherein a pilot descends to his minimum altitude and if he has visual reference to his landing path, regardless of official reported ceiling and visibility, he has the perogative of continuing his approach and landing the airplane.

"In view of potential developments with respect to radar surveillance, we might consider the pilot as a medium of giving us official weather observations during this interim period."

C. M. Christenson: *"Marshall Fay, do you have any suggested problems with respect to a take-off in the climb-weather problem?"*

Marshall H. Fay *(Mgr., Flight Operations, United Air Lines):* "Even though it's fairly warm now, it's soon going to be colder and we'll have snow and precip in the air. Everyone of us has probably made a take-off with snow-cover on the wing, and the take-off has proved to be somewhat marginal. In connection with that, radar has begun to accelerate the departure of trips in heavily congested areas. The thought I have is that we should pursue further the development of radar departure so that we can avoid delays on the ground that result from not knowing whether a plane should or should not take off in a precip or snow-in-air condition. Delays on the ground must be overcome; the pilot can't afford to sit there indefinitely."

Capt. Charles Blair *(Pilot, Pan American World Airways):* "The problem of thunderstorms isn't as bad with Pan American-Atlantic as it is with the domestic airlines, but we do have some thunderstorms between New York and Nova Scotia. We should have more flexibility of airway arrangement between New York and Boston, and New York and Nantucket. If we could get wider airways, we'd be better off.

"We also wonder if some of the ADIZ regulations for inbound aircraft during thunderstorm conditions could be relaxed somewhat. When you're cruising down from Nova Scotia to Nantucket—and that's the

(Continued on page 39)

by Robert L. Brown
Project Engineer, Eclipse-Pioneer

watchdog of the DC SYSTEM

This 12-pound overvoltage and fault protection system guards generators used with any type of aircraft engine

With 10 minutes to go until landing time, activity in the cockpit of the cargo transport was routine. Up to that time the flight had been uneventful: ceiling was unlimited, headwinds were negligible, and the engines were roaring in the twilight without an audible cough. There was no question in the pilot's mind that he and his cargo would arrive on schedule.

Suddenly, the lights in the cockpit became unusually bright. Just as suddenly, they went out. Before surprise could give way to apprehension, the pilot caught a wiff of smoke.

After a minute's hectic search, the copilot found molten metal dripping through a gaping hole in a closed access door, onto some wooden crates. Soon, the crates caught fire.

Fortunately, the plane was able to make a safe landing, and an emergency fire-fighting crew killed the flames. When the partially melted access door was removed, the culprit was discovered: a relay had burned through its housing and continued its searing path through the door. Further study disclosed that the trouble was due to an overvoltage condition caused by a broken lead; the opening of a high-current relay caused an arc to ground within the unit.

This incident actually occurred. Only a few details have been changed to prevent identification and attendant embarrassing publicity. But such an incident is no rarity. It has occurred on different occasions with many types of planes, planes that were not equipped with fault protection systems.

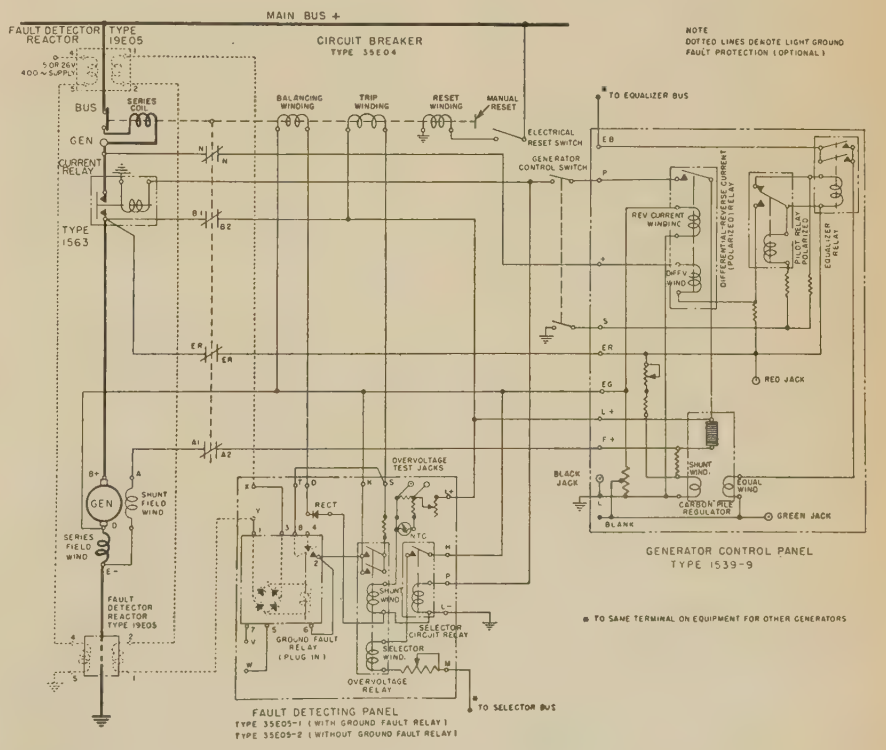
Essentially, a fault protection system is an arrangement that causes the proper generator feeder and field breaker to trip whenever: (1) the voltage of a generator exceeds a certain voltage for a pre-determined interval, (2) a fault to ground occurs in excess of a specific amperage in the generator or any of its associated wiring and equipment, or (3) a reverse current of dangerously high amperage flows through the generator for a pre-fixed amount of time.

A system that guarantees these safety features is now being produced by the Eclipse-Pioneer Division of Bendix Aviation Corporation. Intended for use with 28-volt dc aircraft generators, it consists of the following units: one generator circuit breaker, one fault detecting panel, and two ground fault detector reactors.

This system, which weighs only 12 pounds, can be used with any type of aircraft engine, including jet. Since one complete system is needed to afford protection for each generator (and there is, usually, one generator per engine), simple arithmetic shows that for the equivalent weight of a small suitcase a large transport can have this over-all protection.

By designing the fault protection system in three parts instead of one large panel, Eclipse-Pioneer engineers have made it possible for it to be installed easily in either new frames or in planes that are already in service. Also, already existing control equipment in an aircraft does not have to be scrapped.

(Continued on page 44)



DIAGRAM—*Eclipse-Pioneer's overvoltage and fault protection system, using a control panel*

Performance

from the Files of the Flight Safety Foundation

COMPLACENCY VS. SAFETY

Re. "Keep Your Seat Belts Fastened" from a letter to Flight Safety Foundation: "Sudden, violent and unexplained turbulence must ever be impressed on crews. I made quite a long trip in the front end of an air transport not so long ago. The copilot did a beautiful job, but the captain at no time used his belt. He smoked during take-off and landing and seemed to me to be utterly contemptuous of some of the fundamental hazards which I have a lot of respect for. We all know that some accidents have been justly attributed to the fact that 'familiarity oftimes breeds contempt.' Pressure along that special line is not too easy to exert but it is important. Think you not?"

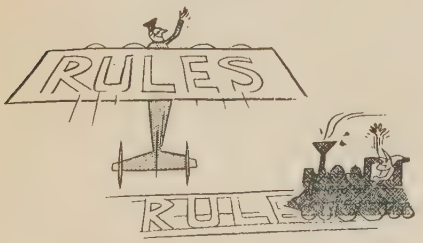
SOUND ADVICE

The following excerpt is from a letter by D. B. Robertson, International President of the Brotherhood of Locomotive Firemen and Enginemen, to the officers and members of the Brotherhood.

Although written in terms of railroading, the advice is equally applicable to public transportation by air or by any other means. It is repeated here because of its sound value to the cause of safety.

"Safe railroad operation demands absolute observance of every safety and operating rule as well as giving thorough attention to the last and most minute detail in connection with train orders. Only by complete observance of rules and orders can enginemen discharge their full responsibility for the protection of the traveling public, themselves and the property of the railroads and at the same time insure that the trains operate efficiently and economically.

"As you know, during the investigation of every railroad accident, great emphasis is placed upon what is called the 'human element'. Authorities inquire into every detail concerning observance of signals, train orders, and safety and operating rules.



"The operating rules are compiled from the best railroading experience gained down through the years since the throttle was opened on the first locomotive operated on the North American Continent. Those rules were prepared with the primary consideration of promoting safety and efficiency on the rails.

"I am certain that every engineman fully comprehends the gravity of his duty with regard to observance of all safety and operating rules. That responsibility is part of his daily life from the minute he starts his first trial trip. He not only lives with the rules; he lives because of them and they are the protection of his life and his job. They are an inseparable part of the railroad tradition of which we are justly proud and determined to preserve."

MENTAL WINTERIZATION

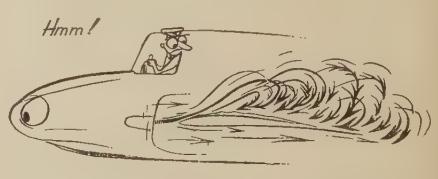
One large airline has issued the following precautions for winter operation—and this should concern everybody!

"As we all know, we can expect seasonal deterioration of flying conditions. During the past 12 months, we have enjoyed a fine operating record from the standpoint of safety, passenger comfort and schedule reliability. It is extremely important that each of us thoroughly considers the necessity of continuing this record throughout the winter, with particular emphasis on *safety*. Although schedule reliability is a most important factor in attracting the air traveler and in leveling out the normal seasonal slump in business, the importance of the continual exercise of sound judgment with all decisions weighted towards the side of conservation is, by far, the factor which will mean success or failure. The stakes are too high to 'take a chance.'

"Know Where You Are Before You Let-Down. This is an old axiom which should need no long involved explanation. Nevertheless, it is well to remind ourselves that we must follow this tried and proven practice of air safety. A recent fatal accident provides an example of the results which are possible when definite positive knowledge of the exact position of the airplane is not known before letting down into an overcast. Use more than one facility to check your position and course!

"Instrument Approaches and ILS. Earlier this year two airplanes got into serious trouble while making ILS approaches. These were undoubtedly due in part to non-adherence to prescribed approach procedures and to the absence of a careful, precise flight technique by the crews involved. I would suggest that you review: 1) all previously issued instructions and notes relative to the use of low-approach equipment with particular emphasis on the obtaining of definite assurance that the equipment is working properly before letting down to minimum altitudes; 2) the prescribed procedures for cockpit coordination; and 3) the allocation of specific duties between the members of the crew on the flight deck. Make certain that before entering into the area of approach control that each member of the crew understands what he is to do and when and how to do it.

"Keep Your Seat Belts Fastened. We cannot stress too highly the necessity for Captains, First Officers and Flight Engineers to wear their seat belts at all times in the cockpit and to keep them fastened snugly. Severe turbulence (which we know has been encountered in clear air, particularly in the Western Regions), the possibility of automatic pilot failure, and the remote chance of explosive decompression, are all possibilities which, though admittedly remote, could cause serious injury to any of the crew members and perhaps loss of control of the airplane.



"Don't Take Off With Frozen Precipitation On The Wings. Every year somebody attempts to take off with frost, snow or ice on the wings and cracks up with serious or fatal results. It has happened to us. Don't do it.

PITFALLS

by Jerome Lederer and Robert Osborn

"Take It Easy On Slippery Runways. Remember that a steerable nose wheel is ineffective in attempting to steer on ice or snow. If a nose wheel which has been turned partly over in an attempt to steer the airplane while sliding on a slippery runway strikes a dry spot on the pavement, there will be heavy loads imposed on the structure which can very easily fail the nose wheel assembly. Remember the roadside warning signs 'Slippery When Wet.'

"Oil Dilution. Review the appropriate sections of the airplane flight manuals for instructions concerning the use of oil dilution system. When necessary to park an airplane outside in sub-freezing temperatures this winter, use the oil dilution to facilitate starting. At points where mechanics are available, check with them for advice. You may be able to turn a long delay into an on-time reparture.

"DC-3 Pilots. Review that part of the DC-3 Instruction Manual which concerns the operation of the steam-heated system. Every year the advent of low freezing temperatures has caused numerous delays due to frozen boilers and numerous flights with frozen passengers. Remember to have the steam pressure up and the heater operating satisfactorily before take-off."

WARNING!

The Chief Pilot of a scheduled airline writes:

"We all know that under very stable conditions an approach can be made under lower ceiling and visibilty conditions than may be prescribed for a particular airport, *but during turbulence, snow, heavy rain, and other aggravating conditions that very often exist,* it would be much better if a higher ceiling and better visibility would be used. This is one condition which I think should receive much consideration to improve the safety of our operations."

The dangerous element is that no matter what your minimums are, if you cannot see a *horizon* when contact and you level out, the safety of your flight is jeopardized even if you see a light or row of lights. (Read Flight Safety Foundation's *"Sensory Illusions in Flight".*)

Look at the 1951 record:

Burlington, Iowa: Enroute from New York to Kansas City, flight encountered headwinds much stronger than anticipated, together with heavy icing conditions. Captain then determined he could not continue to Kansas City and land with the minimum fuel required, and he requested a clearance for Burlington. During the

approach at Burlington, the threshold lights were visible but not the runway boundary lights which had been *obscured by blowing snow.* Aircraft touched down off to right side of the runway in deep snow, and nose gear was sheared on a snow-filled ditch. Substantial damage resulted.

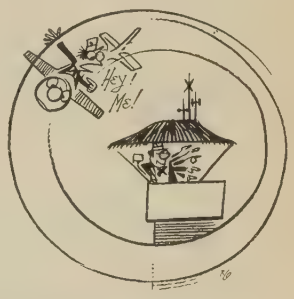
Sioux City, Iowa: DC-3A. Following an instrument approach, pilot reported contact over the SE corner of the airport and was cleared to land on Runway 13. He apparently missed his approach to 13 and turned left in an attempt to maintain VFR and land on Runway 17, with a left crosswind. Aircraft stalled and crashed a short distance from the approach end of Runway 17. Fire developed immediately. Visibility was restricted in snow. Pilot, two crew members and 13 passengers were killed; aircraft was destroyed.

Minneapolis, Minn.: Lockheed 10A. Appears pilot misjudged altitude and leveled off too high due to layer of light snow stirred up by another landing aircraft. As he attempted to recover, aircraft fell off on left wing and hit on one wheel. Aircraft bounced, veered off runway and collided with a snow bank. Leading edge of wings had a coating of clear ice, which pilot had unsuccessfully attempted to break enroute by use of de-icer boots. Aircraft was damaged substantially.

Keflavic, Iceland: After contacting Approach Control, flight was advised that the runway was plowed clear of snow for its full length and 150 feet wide. It was assumed pilot knew runway was 200 feet wide and he was not advised of snow piled inside the runway lights. A GCA approach was made and flight became VFR at approximately 550 feet, with some visibility restriction due to blowing snow. During a normal landing, the right wheel ran over a snow ridge left by the plows, and aircraft straddled this ridge for approximately 250 feet. At this point the nose gear came in full contact with the ridge and was sheared off. Aircraft then skidded to a stop with the nose plowing through the snow. Damage was substantial.

Minneapolis, Minn.: Pilot, upon becoming contact, elected to abandon his ILS approach and continue the descent visually. Visibility was variable and heavy snow banketed the airport, partially obscuring runway and runway lights. Pilot failed to maintain proper alignment with the runway and landed to the right of it in deep snow, between flag markers on north side of runway and south side of taxiway. As aircraft plowed through deep snow, the nose gear collapsed. Aircraft damage was substantial.

Even if communications are rushed, insist on getting information on weather conditions (including turbulence, snow, ground haze, rain, sleet, plus snow kicked up by props, etc.) along with minimums.



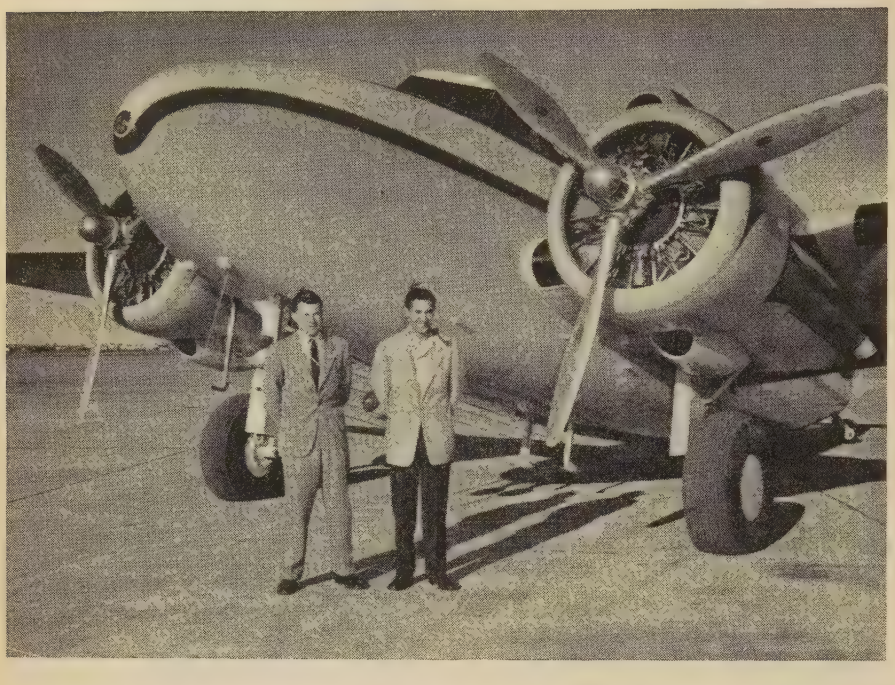
ITINERANT PILOT AND BUSY CONTROL TOWER

Pat and Mike worked in a large machine shop. One day, Pat was oiling a huge fly wheel. It must have been 25 feet in diameter . . . tremendous. Someone called his name and Pat looked away. In that instant, his sleeve caught in the wheel and he was shipped off his feet. 'Round and 'round he whirled, while Mike stood by, speechless, frozen with horror. Suddenly he jumped into action and pulled the switch. The wheel slowly stopped. Mike rushed over to Pat and said, "Speak to me, Pat, speak to me!"

"Why should I?" groaned Pat. "I passed you a dozen times and you didn't speak to me!'

SKYWAYS FOR BUSINESS

NEWS NOTES FOR PILOTS, PLANE OWNERS OPERATING AIRCRAFT IN THE INTEREST OF BUSINESS



MICHIGAN TOOL CO. *now operates a Lockheed Lodestar modified for executive flying purposes by Southwest Airmotive. Pilot and co-pilot of the newly modified Lodestar are Paul Holst (right) and Otis List, shown here just prior to take off for home base, Detroit*

Michigan Tool Company Flying Southwest-Modified Lodestar

Dallas, Texas. The Michigan Tool Company of Detroit is now flying a newly modified Lockheed *Lodestar* as a business transport. Work on the surplus Navy *Lodestar* was done by Southwest Airmotive.

The cabin features six Burns of California seats covered in brown basket-weave material, and a grey divan. The rug and plastic leather sidewalls are brown and the upper sidewalls and headliner are a light tan Bridgeport fabric. Curtains also are light tan. Three removable tables, a bleached mahogany storage cabinet and the Craftsman cabin radio are topped with formica. The radio operates off a 110-volt converter. The lavatory in the *Lodestar* is upholstered in light tan plastic leather and, like the rest of the cabin, its upper sidewalls and headliner are a light tan.

Up in the "front office", dual flight sections have been provided for the pilot and copilot. Dual engine instruments have been moved to the center of the panel, and added on the copilot's side were altimeter, turn-and-bank, airspeed, horizon and directional gyro, two volt amp-meters, fuel flow indicators, and vacuum gauge for copilot's gyros. Oil shutter and fuel gauges were added on the pilot's side. Simplex radio controls and the re-grouping of instruments make it possible for the pilot to operate the aircraft single-handed.

Two pilot heads are used, one for the copilot's altimeter and airspeed, and the other for the pilot's altimeter, airspeed and rate-of-climb indicators. A dual vacuum system was installed, with a selector valve, so that either set of flight instruments can operate from engine or vacuum pump.

The instrument panel itself is painted in black crackle; is engraved where necessary, and individual Grimes lights, with three rheostats, have been installed; one rheostat for the pilot's flight instruments, a second for the engine instruments, and a third for the copilot's flight instruments. The instrument panel was designed in one piece instead of the conventional three, and the electrical instrument wiring is connected to two common cannon plugs, providing easy panel removal for future maintenance. The pressure and vacuum sources were plumbed in Aeroquip hose and connected to a common outlet. The panel was mounted in the aircraft on 35 #4 Lord mounts.

Just aft of the cockpit, Southwest built a compact all-metal galley, complete with storage bins, thermos bottles, work-top and drain.

Across the aisle is the navigation compartment. A large flight map is spread beneath a plexiglas top on the table, and underneath it is a metal rack for map storage purposes. A metal rack above the table holds the crew's Jeppesn Manuals.

Exterior of the *Lodestar* is painted grey, with white top, blue and yellow stripes.

Mechanic Develops Modification for D18S to Ease Maintenance

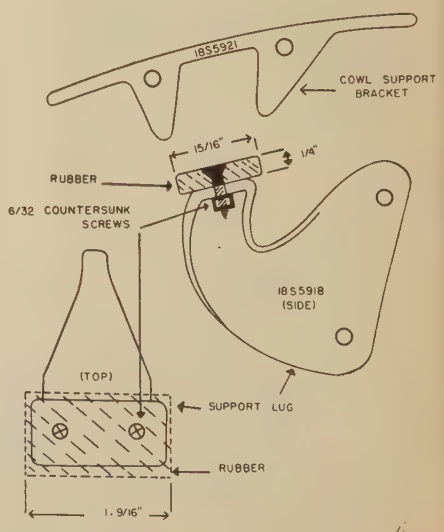
Denver, Colorado. With generosity of idea characteristic of the pilot-mechanic group, Louis A. Labe, pilot for The California Company, offers Twin-Beech operators a help in easing one particular maintenance headache. This involves the D18S cowling and is an idea developed by R. D. McKiernan, mechanic for R. L. Manning Company. Both the California Company and R. L. Manning Company base their aircraft at Stapleton Airfield.

It has long been a maintenance job to replace the micarta strips, cowl support brackets and rivets due to wear of the micarta strips and popped rivets attaching the strips and supports to the cowling. Mr. McKiernan found a way to eliminate this time-consuming task and the idea has been adopted by many other Twin-Beech operators. In some cases, no cowl work has been necessary in over 200 hours of operation.

Mr. McKiernan's modification is to remove the micarta strips from the sides and bottom of the cowl support brackets (Beechcraft Part #18S5921). Then, using gas or fuel hose of large size, rubber belting or good rubber with cords that are ¼-inch thick, cut a 1 9/16-inch and 15/16-inch rectangle. Mount this pad of rubber on the support lug (Beechcraft Part #18S5918) by drilling two holes to take #6 countersunk screw and elastic stop nuts on back (*see diagram below*).

After this modification has been made, pilots and mechanics will find that the only wear is on the rubber pads, and these can be easily replaced with screwdriver and wrench.

Another advantage to this modification is that the cowlings do not seem to vibrate as much and are easier to put on and take off.



Aero Design and Engineering Co. Building Eight Aircraft a Month

Bethany, Oklahoma. Aero Design and Engineering Co., builders of the popular twin-engine *Aero Commander*, has come a long ways in a comparatively few months.

Delivery of the first *Aero Commander* was made in January, 1952, and since that time, production of the 5/6-place *Commander* has increased from four to eight airplanes a month, and the company has delivered over 100 airplanes thus far.

Herb Fisher, SKYWAYS' roving test pilot who reported on the aircraft's performance a year ago, recently flew one of the latest *Aero Commanders* from Dayton, Ohio, to New York. Mr. Fisher reported that he observed many outstanding improvements, and re-affirms his enthusiasm for the *Commander's* performance.

CAA Reports Increase in Use of Airways Facilities in '53

Washington, D. C. Wider use of improved airways facilities and a significant increase in all-weather flying are shown by the CAA figures of increased fix postings by the Air Route Traffic Control Centers during fiscal 1953. A total of 14,329,408 fix postings were recorded in CAA traffic centers during the year. This represents an increase of 13% over 1952. A fix posting is a report made by a military or a civil plane at a check point along the airways, and posted on a flight progress board at the center.

Twelve of the 31 CAA air route traffic control centers handled more than 500,000 postings during the year. Atlanta increased its operation by 28%, Jacksonville by 29% and Los Angeles by 22%.

The busiest centers were New York with 1,508,229; Washington with 871,938; Oakland (Calif.) with 858,096 postings. Boston chalked up 558,182; Chicago, 804,967; Cincinnati, 724,463; Cleveland, 771,453; Atlanta, 712,893; Jacksonville, 606,034; Kansas City, 623,408; Los Angeles, 602,431; and Seattle, 578,418.

Rivets Developed for Leak-proof Sealing of Fuel Tanks

Los Angeles, Calif. For leakproof sealing of integral fuel tanks, Pastushin Industries, Inc., has developed their "Fluid-Tight" rivet. These rivets are currently being used on the new Douglas DC-7's.

The rivets were developed for use by aircraft manufacturers and airlines for repair and maintenance of aircraft sealed assemblies, including integral wing fuel tanks, pressurized cabins and fuselages, and hulls and pontoons of flying boats. The rivets are modified close-tolerance, standard, flush-head AN 426 or round-head AN 430 aluminum alloy rivets and are available in a variety of sizes. Possessing full rivet strength values, the "Fluid-Tight" rivets replace standard AD rivets without loss of joint efficiency. Installation is by conventional riveting tools and methods.

Pastushin Industries has additional information available. Write: Dept. R, 501 Prairie Ave., Hawthorne, Calif.

....in the Business Hangar

Mine Safety Appliances, Pittsburgh, has their newly converted DC-3 at Remmert-Werner in St. Louis for installation of a Sperry A-12 Autopilot. M. L. Nicholson is pilot of the green-and-white DC-3.

Marshall Tarbert and Fred T. Epson, pilot and copilot of the Pure Oil Company DC-3 had the business plane at Northwestern Aeronautical Co., St. Paul, for hundred-hour check.

Bechtel Corp. has its *Lodestar* at Lockheed Aircraft Service, Burbank, for relicensing and other services.

Bob Cowling, pilot of the Twin-Beech owned and operated by Southern States Life Insurance Company, brought the airplane to Horton and Horton, Houston, for new interior design and fabrication.

The Timken Roller Bearing Co. has its B-25 in the hangar at AiResearch Aviation Service for interior modification, installation of wing-tip tanks and a folding step-door, and thousand-hour check.

Skip Wittner, pilot for Kewanee Oil Company, just took deilvery of a new Remmert-Werner Deluxe Executive DC-3. The plane is powered by R1830-Super-92 engines and is equipped with Collins radio. Kewanee also operates a Twin-Beech and a de Havilland *Dove*, and is a member of NBAA.

The de Havilland *Dove* owned by The Beaver Lodge Oil Co. has been equipped with a Flite-Tronics MB-3 marker beacon receiver. Work was done by Dallas Avionics, Inc. *Dove's* pilot is Robert Whimple.

Glen Durst has the Woolf & Sons *Lodestar* in the hangar at Remmert-Werner for 8,000-hour inspection and overhaul. This particular *Lodestar* is used primarily for hauling tropical fish!

Procter & Gamble Co. has its DC-3, N 4W, flying again after landing gear overhaul, annual relicense and installation of a Barber-Coleman proportioning heater control. Work was done at Stratford Conn., by Mallard Industries. Nelson U. Rokes is Procter & Gamble's chief pilot and NBAA representative.

Steve Brown, chief pilot for Continental Can Co., Morristown, N. J. flew the company B-26 to Qualitron, Burbank, for installation of a Flite-Tronics MB-3 Visual-Aural three-light marker beacon receiver.

Thompson Products, of Cleveland, has two of their DC-3's in the hangar at Remmert-Werner for Sperry A-12 installations and cockpit re-work. Meanwhile, pilots Bob Sheriff and Jim Stopper are keeping their flight schedule going via another DC-3 leased from Remmert-Werner while their own planes are in the hangar.

Cotton Jetter and M. A. Storey, chief pilot and pilot of the Convair 340 owned and operated by Union Producing Company, have had the 340 at AiResearch Aviation Service for installation of an executive interior.

The *Lodestar* owned and operated by The Columbia-Geneva Division of U. S. Steel has been at Qualitron for installation of a CA-20 cabin amplifier. Roy Rollo is the company pilot. Also at Qualitron for CA-20 installation was the DC-3 belonging to Sears, Roebuck & Co. William S. Dameron, Jr. brought the Sears DC-3 to Burbank from its Atlanta, Ga. base.

If Herb Fisher, Skyways' test pilot and the Port of N. Y. Authorities' head of aviation promotion and development, is still blustering, it's because Herb's official pass to the National Aircraft Show read, "*Sky*ways" instead of "Skyways". A typographical error that did not go unnoticed!

Fullerton Oil Co. has equipped its B-26 with a Flite-Tronics CA-20 cabin amplifier and an MB-3 three-light marker beacon receiver. Installation was made by Grand Central Aircraft Co. at Glendale, Calif.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1029 Vermont Ave., N. W. Washington 5, D.C. Phone: National 8-0804.

Co-Sponsors of Lindbergh Flight Win '53 NBAA Award

The National Business Aircraft Association's annual award this year was presented to E. Lansing Ray, Publisher of the St. Louis *Globe Democrat*; J. D. Wooster Lambert, and Harold M. Bixby, vice president of Pan American World Airways, for co-sponsoring the first non-stop flight from New York to Paris of Charles A. Lindbergh in the "Spirit of St. Louis" on May 20-21, 1927 Presentation of the special award was made at NBAA's annual banquet which closed the association's Sixth Annual Meeting and Forum, at St. Louis.

Pilots and Member-Companies Recipients of NBAA Awards

Another highlight of NBAA's Annual Meeting at St. Louis was the presentation of annual awards to member organizations and first pilots with outstanding safety records in business flying.

Pilot Proficiency awards were made to first pilots of each member organization that had flown 500,000 or more accident-free miles. These were:

James E. Kidd, Anchor Hocking Glass, Corp., Lancaster, Ohio; *Walter C. Pague*, Armco Steel Corp., Middletown, Ohio; *L. E. Gray, E. F. Ross, Robt. N. Arms, C. F. Zimmerman, Charles S. Blood* and *John L. Corlett* of Continental Oil Co., Ponca City, Oklahoma; *O. A. Weindel*, Deer & Co., Moline, Illinois; *Col. E. W. Estelle* and *Donald L. Provost* of Esso Shipping Co., New York City; *Jack C. Jones*, Fairbanks, Morse & Co., Chicago; *J. R. Jefferies*, D. D. Feldman Oil & Gas Co., Los Angeles; *Roger E. Parrott*, Fuller Brush Co., Hartford Conn.; *Lee Dorrance, Jr., Wm. E. May, Alyn Harrison, Jr.* and *Ernest B. Brown* of Gaylord Container Corp., St. Louis; *Charles L. Sharp*, Great Lakes Carbon Corp., New York City; *Forest R. Conover*, Ideal Cement Co., Denver; *Carl J. Lund*, International Paper Co., Mobile, Alabama; *Robt. L. Hansen* and *Sam Safris*, Kroehler Mfg. Co., Naperville, Illinois; *Ralph E. Piper, George E. Meyers* and *Richard N. Thurston*, Monsanto Chemical Co., St. Louis; *Elmer C. Spencer*, Murray Corp. of America, Detroit; *P. J. Healey* and *H. R. Anderson* of National Automotive Fibres, Inc., Detroit; *William R. Strong*, National Dairy Products, New York City; *A. L. Ueltschi*, Pan American World Airways, New York City; *George W. Vaughan*, H. H. Phillips Drilling Corp., San Antonio, Texas; *Nelson U. Rokes* of Procter & Gamble Co., Cincinnati, Ohio; *L. R. Collins*, Republic Aviation Corp., Cleveland; *W. F. Underwood, Lawrence C. Thompson, David G. Peterson, David H. Bishop* and *Joseph L. Lacey* of Sinclair Companies, Tulsa; *J. Sheldon Lewis*, Thatcher Glass Mfg. Co., Elmira, N. Y.; *L. N. Lacey* of Triangle Conduit & Cable Co., New Brunswick, N. J.; and *Tom R. Neyland* of Albert Trostel & Sons Co., Milwaukee, Wisconsin.

Special Meritorious Awards also were conferred upon member organizations that had flown business-owned aircraft 1,000,000 or more accident-free miles. Recipients were:

Company	Miles Flown
Continental Oil Co.	2,448,386
Esso Shipping Co.	2,000,000
Great Lakes Carbon	1,298,742
International Paper	1,292,242
Kroehler Mfg.	1,170,346
Malco Refineries	1,250,000
Monsanto Chemical	3,019,625
Nat'l Auto. Fibres	1,263,975
Ohio Oil	5,261,328
Pan American	1,000,000 plus
Phillips Drilling	1,122,674
Pratt & Whitney	1,110,000
H. C. Price Co.	1,478,804
Sears, Roebuck	1,275,000
Sinclair Refining	2,753,464
Albert Troestel & Sons	1,087,500

Pilot awards were made at the NBAA Annual Luncheon; the member-organization awards were made at the NBAA Annual Banquet.

Eight More Companies Become NBAA Members

Applications for Membership in the National Business Aircraft Association from the following companies have been approved by NBAA's Board of Directors:

Aeronca Mfg. Corp., Middletown, Ohio. Mr. H. C. Pettit, Sales Manager, is NBAA representative, and the company operates a Beech *Bonanza*.

Auto Transports, Inc., Oklahoma City, Okla. D. W. Rentzel, president of the company, recently was elected a member of NBAA's Board. Joseph N. Snelson is chief pilot, and the company operates a DC-3 and a *Bonanza*.

Bell Aircraft Corp., Helicopter Div., Fort Worth, Tex. Floyd W. Carlson is chief pilot, and the company operates a Bell F-59, a Bell P-39 and an F-63, plus two Bell helicopters, a Beech C-45, Grumman F4F and F6F, and a Sikorsky Helicopter.

Davison Chemical Corporation, Baltimore, Md. Edward F. McFee is chief pilot and the company operates a DC-3.

Indiana Gear Works, Inc., Indianapolis, Ind. Maxwell Jobst is chief pilot, and the company operates a DC-3, a Twin Beech and a *Bonanza*.

Magnavox Company, Ft. Wayne, Ind. Chief pilot is Stephan Richards; business plane is a DC-3.

Service Pipeline Co., Tulsa, Okla. John A. Bouteller is chief pilot. Company's fleet of aircraft include two *Lodestars*, two Cessna 195's, six Cessna 140's and a D18S.

Zollner Machine Works, Ft. Wayne, Ind. Chief pilot is J. C. Cooney. Company operates a DC-3.

Decommissioning of L/MF Aids Supported by NBAA Members

NBAA has given strong support to the recommendation that non-essential L/MF four-course radio ranges be decommissioned gradually. It is the contention of NBAA, as set forth during a recent session of the ACC Navigation and Air Traffic Control Panel, that the usefulness of these aids to flight under VFR conditions is limited and that they also are expensive to operate and maintain. Although it is recognized that radio communication and air navigation aids are very useful during good weather conditions, CAR require their use only during IFR weather. NBAA therefore voted for gradual decommissioning of 335 L/MF aids but supported temporary retention of 88 "general service" ranges across the country. They will meet necessary VFR communications and national defense requirements, pending evaluation of their over-all usefulness. NBAA also recommended that funds allocated for L/MF aids might be better utilized for the installation of additional VOR units.

New Airports Opposed In SF-Oakland Area

The industry-government airport use panel has recommended that no new airports, generating air traffic which would prevent maximum utilization of San Francisco International airport and Oakland Municipal airport, be constructed in the San Francisco Bay area.

The panel also recommended removal to another airport of military units based at Hayward airport in the event they are selected for jet equipment. It also was suggested that a master area airport development and operational plan might be evolved through a series of semi-annual conferences of San Francisco Bay area airport operators and local, federal and military officials.

NBAA representative at the Berkeley meeting was Richard W. Lane, chief pilot for Food Machinery & Chemical Company, San Jose, who presented the Association views of these problems.

'Copter Operations Face IFR Approach Problems

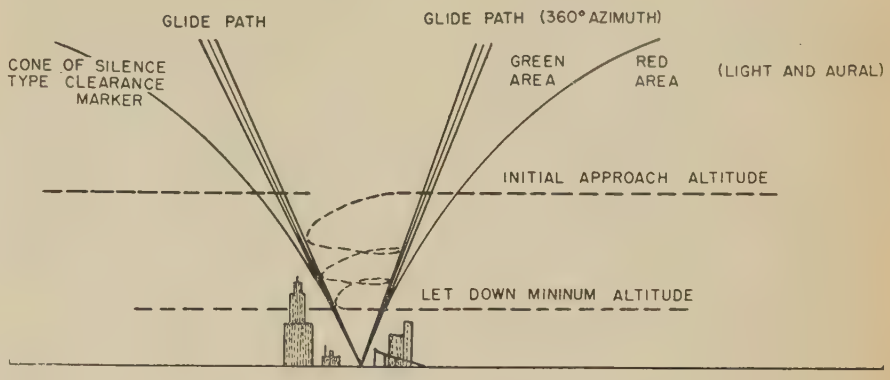
It may come as a surprise to many conventional-aircraft pilots as well as the general public that helicopters as such are not all-weather aircraft. The oft-visaged spectacle of a helicopter milling its way happily through the soup, occasionally coming to a halt, then going around or up to evade some sudden high ground obstruction or traffic on the highway, etc., simply does not exist, at least not today.

Under certain very limited special circumstances, it is not denied that certain of the very light types in comparatively open country could operate in this fashion where no pressure of schedule or time existed. In heavy metropolitan areas, which are the best present markets for helicopter service, this is a physical impossibility right now.

As an example, pure control alone is such a problem that only recently have the outstanding helicopter operations in areas like Los Angeles, etc., gone to limited IFR operation. Chicago and New York still are evaluating the results of a substantial period of night operation. With the improvement in both boosted manual control and automatic control, the day is approaching when fairly normal IFR operation will be contemplated. With it will come the associated problems of instrument or radio navigation on approach, plus traffic control separation and sequence.

With the larger or bus-type helicopters now coming on the market, present weather limitations on helicopter operations, whereby they *stay down out of the weather,* will seriously hamper their schedule capabilities. The nature of their short-range operation is such that virtually all-weather completion of schedules must be assured the passenger or the competing, if slower, ground services will be too alluring by comparison. Ground trips in the neighborhood of an hour guaranteeing arrival close to schedule are too strong competition for air service of even one-third or less that time but subject to uncertain delays of as much as an hour and then, possibly, cancellation.

Acknowledging this fact, the growing "air-bus" industry is looking to this winter to reveal the answers to many of these problems. Inasmuch as the helicopter must operate from and to many locations where terminal and approach radio aid facilities do not exist, a need for an over-all covering system is apparent. You cannot let down for a heliport in suburban areas on current precision approach systems at the terminal airport for the metropolis in question. Not only are such facilities limited to certain strict alignment for obvious reasons but coverage at low altitude away from a big instrument runway is virtually nil.



The British Decca system is reported sufficiently accurate and, on the basis of the grid-type system, their experiments indicate possible accuracy approaching the required 200 feet laterally. American operators are investigating the possibilities of the VOR/DME combination, but with an open eye to the promise of the economical and surprisingly accurate TVOR.

Then, inasmuch as the popular conception of vertical let-down over a pre-selected spot whether VFR or IFR is not a practical fact of life but for adequate safe approach, a minimum of slant descent is preferred, the problem of glide slope rears its head again. In this respect, obstruction clearance at a present-day large terminal airport would be duck-soup.

Helicopters can and do descend at angles of 75° and 80° from the ground plane, which would eliminate obstruction clearance problems at the airports which have surveyed approach lanes allowing 3° glide slopes! The sticker is when the helicopter wants to make an IFR approach to the suburban or mid-town heliport between buildings and obstructions where almost vertical descent is a must. This demands a new type of IFR approach aid. A fascinating possibility is that it could be a 360° inverted cone-type glide slope within which, once penetration is assured at any altitude, safe descent from any direction could be made, preferably into the wind, another practical necessity despite common misconception.

Tests with many systems, including the British one-man radar (primarily azimuth control only, like our ASR radar), use of dual-ADF on two closely associated radio beacons, VOR/DME, Pictorial Computers, etc., have been in progress for some time at the Quantico Marine Air Base. Results are expected to be published very soon. Rumors have sneaked out that present IFR instrumentation is not adequate for public common carrier helicopter operation. Reports of tumbling gyros, limits of 1,000 feet and 3 miles, poor vertical guidance and near collisions with obstructions suggest that all is not yet well. Many of the techniques that are being developed at Quantico will be given limited service investigation this winter at New York, Chicago and Los Angeles.

ATC-wise, helicopter people protest the present application of ANC-IFR standard separation and are asking for relaxation of the current 1,000-foot vertical rule and lateral separation comparable to one city block! Reduction of vertical separation to 500 feet where both aircraft are under radar control is an established standard and should ease that problem, but it is highly unlikely that other conventional aircraft pilots on low approach or the Air Safety Division people will buy the reduced IFR lateral and separation except where the helicopter is definitely underneath

(Continued on page 28)

'Copter Operations Face IFR Approach Problems

(Continued from page 29)

and visible to airport control personnel, which is not true IFR separation.

It was claimed that, inasmuch as primary approach to a low altitude can be made irrespective of wind direction, simultaneous operations away from and offset from conventional IFR approach paths can be made. The short final let-down into the wind could then be made parallel with adequate provision for the unanticipated missed approach. It is doubtful, however, that any path convergent with another aircraft from any altitude will be approved regardless of the final expected turn to a parallel heading.

At first glance, the foregoing may present a gloomy forecast of the possibilities of full-IFR helicopter operations. Nothing could be less true. We merely suggest that such operation is not a minor problem to be solved overnight.

Having arrived in the vicinity of the heliport approach area by VOR/DME, ADF or other navigational means, the helicopter would maintain the initial approach minimum altitude until both the aural and visual marker indications had been received that the aircraft was in the safe let-down cone area. Intercepting the Glide Path transmitted in all directions, let-down could be started either by circling tangentially down the Glide Path "wall" or by high-angle descent if individual heliport area surrounding obstructions permitted a lower angle Glide Path and/or Cone of Safety. If not visual by the time minimum let-down altitude is reached, a missed-approach climb would be executed tangentially back up the "wall" or at high-angle climb if feasible.

Air-Aids Spotlight

ALBANY, N.Y.—*CAUTION on IFR approach from north! There are three (3) VHF markers on final, the ILS Outer Marker, the LF Range "Z" marker and ILS Inner Marker consecutively. Check both lights and aural signals.*

BOSTON, Mass.—*There are two (2) thresholds landing runway 4R! Necessity of placing Middle Marker on approach end of runway results in two different lengths of available runway for landing and take-off. (See Newark note).*

CHATTANOOGA-KNOXVILLE, Tenn.—*Frequency confliction resolved by putting North Chattanooga MHW on 219 kc ("CQN") and Knoxville LOM on 215 kc ("TY").*

ITHACA, N.Y.—*Cornell Univ. TVOR on 115.6 mc ("ITH"). Like the Army TVOR at Utica, this is NOT a public facility and IFR use, except by prior arrangement, is hazardous.*

MOLINE, Ill.—*BVOR now on 113.2 mc and at new location 56° magnetic 21.25 miles from Moline LF range.*

NEWARK, N.J.—*There are two (2) thresholds on Runway 28 landing and taking off west, due to landing clearance required over New Jersey Turnpike at approach end.*

PHILADELPHIA, Pa.—*4,000 foot minimum on Red Airway 3 between Mount Holly and Matawan due to Ft. Dix Danger area.*

TULSA, Okla.—*Turley MHW on 201 kc relocated to Middle Marker site to serve as ILS Middle Marker Compass Locator.*

Eastern ATC Routings Face Possible Change

Because modern air navigation and communications is so inextricably mixed with air traffic control and airways operations problems, NAVICOM has increasingly featured ATC problems, innovations and procedures as well as airways changes.

Inasmuch as the most complicated ATC and procedure problems are in the congested eastern U.S. areas, it is inevitable that more of these will be brought to the reader's attention than those from the less dense traffic areas. Nevertheless, it will continue to be the policy to regard all parts of the nations airways and report as soon as practical on any vital problems.

In the Philadelphia area, there is a strong possibility that IFR traffic southbound from New England and NY towards Washington will no longer follow the devious dog-leg routing of Red 72 to Willow Grove (ADF & LF range combination), Red 45 (ADF) to Lancaster, Red 33 to Westminster (LF range intersection), Red 29 to Ellicott City (same), ADF direct to Riverdale radio beacon on Amber 7, etc. With the introduction of the Victor airways operation, Victor 3 will take the flight past Philadelphia and back on to Amber 7 at Baltimore.

In the Pittsburgh area, the commissioning of the Westover radio beacon ("ESV" on 329 kc) has rerouted Red 13 south of its old location and provides better separation from traffic on Green 3, easing Cleveland eastbound traffic.

There is a strong move afoot to simplify all airway flying in the congested eastern areas by redesignating all the airways to provide main long-haul routings in proven heavily traveled directions. Even for traffic employing many of the present main routes like the Green and Amber airways, there are intricate, multiple color and Victor airway routings before or after the pilot gets on the main routes. These designations would be altered to give the main airway designation numbers to the actual routes worked out in operations.

In the Washington Baltimore area, the Washington Center has need for parallel airways by-passing the Aberdeen Danger Area north-south in lieu of the present circuitous Amber 7 and Green 5 routes.

Some airline pilots are complaining about the elimination of "NO DELAY EXPECTED" from ATC clearances, also the substitution of "VIA FLIGHT PLANNED ROUTE"; the former used when no "EXPECTED APPROACH TIME" is given and the latter in lieu of redescribing the detailed route filed by the pilot. Both are steps to reduce radio congestion.

The Washington area experiment with 100% control within a 25-mile radius, 700 feet to 3,000 feet may go into effect despite efforts of self-constituted "watchdogs of the people," professional protestors against any efforts to resolve the knotty problem of air safety in highly congested airspace. The 700-foot minimum is designed to allow light aircraft unhampered access to and from local VFR airports within the periphery of the area, and above 3,000 feet free over-passage in VFR conditions.

The New York area may have to try a slightly different pattern, restricting inbound traffic in marginal IFR-VFR conditions to IFR plan enroute the major terminals effective about 75 miles out along the airways at points like Coyle intersection

(Green 5 from south), Mt. Holly (Red 3), Selinsgrove (Green 3), Erie (Red 23), Poughkeepsie (Blue 18), Monroe (Amber 7 from north, St. James intersection (Green 5 from east.) Lightplane VFR traffic to unaffected airports in area would be requested to avoid the approaches to the major terminals in such conditions, and if the plan is successful, no general restriction would be necessary.

Although pilots may still file "Five On Top" as an IFR plan, it may no longer be imposed as part of an IFR clearance in the congested northeast U.S. Not only does it provide an incalculable overload in congested terminal areas on arrival when IFR approach is necessary, but it can bind a pilot unable to maintain Five On Top" when ATC altitudes below him are reserved. There are few areas left in that part of the country where a pilot can descend IFR off airways to rejoin airways at a vacant altitude!

New York Center Allocates One-Way IFR Altitudes

In a recent Information Bulletin published by the New York Center to all its "customers," it was announced that, to achieve maximum utilization of altitudes on heavily traveled airways, the Center has found that greatest efficiency can be obtained by allocating blocks of adjacent altitudes for "one-way" IFR traffic.

For example, on Red 23 between Paterson and East Scranton intersection, all altitudes from the minimum enroute altitude to and including 16,000 feet are normally assigned to westbound traffic. Similarly, on Green 3 between Brookville and New Brunswick, altitudes from 7,000 feet to 17,000 feet are assigned to eastbounds.

The process of "laddering" aircraft up to or down from cruising altitudes will, at times, modify the upper or lower limits of an existing "block". To a lesser extent, these procedures are used for short periods of time on airways not normally considered "one-way" airways. Therefore, pilots in adhering to the provisions of IFR clearances while flying in weather conditions *at or better than VFR minimums,* will be occupying assigned IFR altitudes which will be at variance with the appropriate altitudes for direction of flights proceeding VFR in accordance with CAR 60.52. As a result, IFR and VFR traffic may frequently occupy the same altitude while flying in opposite directions.

Particular emphasis is placed on the "one-way" routes (*chart right.*)

Sperry Announces New Radio Beam Coupler

An advance in automatic flight for safer bad-weather approach and landings by military and commercial planes was displayed by Sperry Gyroscope Co. at the National Air Show at Dayton. A working military version was shown, which was developed under contract to Air Research and Development Command.

The new device will be known as the Radio Beam Coupler in a simplified commercial version soon to follow priority production of the military type. The new coupler becomes a part of the modern high-performance automatic pilot, and introduces more effective usage of the new VOR-omnirange beacons and other radio "tracks" on principal airlanes of the world.

It accurately holds a straighter course and automatically compensates for wind drift while riding omnirange or other beam. In fog, storms or darkness, when approaching airports on the localizer beam, the Sperry coupler promptly detects intersection with the Glide Path, automatically shuts off altitude control, and transfers itself to glide slope control. It thus avoids former hazards of over-shooting the glide path if a pilot fails to manually engage his glide path control promptly enough at the intersection of the two invisible guiding beams.

Automatic approaches on the localizer beam show increased steadiness gained by major refinements in the circuit design. Of special value is an improvement in performance on the glide path, when descending "blind" toward the airport runway.

At this critical time, without any adjustments by the pilot of the pitch knob, the Sperry coupler employs new signal combinations which hold the aircraft firmly at the proper glide angle, regardless of changes in airspeed or other deflecting forces from lowering flaps and landing gear, or turbulent air.

Such automatic stability features are important because of recent advances in aircraft approach speeds.

Automatic navigation enroute, on the new omnirange airways, greatly simplifies cockpit procedures and frees the pilots for needed attention to other responsibilities, especially maintaining an alert VFR watch for other aircraft!

Safety interlocks are provided in the new Sperry device, which prevent engagement or automatically disengage certain functions in case of failure of radio guidance signals from the ground. These guard against malfunctions within the system as well, for protection under all conditions in rugged operational use.

RCA Offers New Electron Tube

A new RCA electron tube specially engineered to shake off the "shakes" of airborne and mobile electronic communications equipment has been made commercially available.

The new "premium" type tube (RCA 6101) is designed specifically for Class A amplifier and control tube in applications where dependable performance hinges on the ability of electron tubes to take abnormal shock and vibration.

It is a top-drawer version of the famous RCA-6J6, a preferred medium-mu twin-triode type., and couples 6J6-type characteristics with the physical ability to withstand the punishing operating conditions of airborne and mobile equipment.

All tubes receive high-resistance short test as well as standard shorts and continuity tests. Production controls and the uniformity of critical characteristics, both initially and during life, insure long and dependable tube performance.

AIRWAY	BETWEEN	BLOCK ALTITUDES From	To	DIRECTION
Red 23	Paterson & E. Scranton	Min.	16,000	Westb'd
Green 3	Brookville-N. Brunswick	7,000	17,000	Eastb'd
Red 72	Bellemeade-Willow Grove	7,000	12,000	Southb'd
Red 45	Willow Grove-Lancaster	7,000	12,000	Westb'd
Amber 7	N.Y.-Wash Bound'y and New Brunswick	5,000	12,000	Northb'd
		4,000	No ceiling	Northb'd
Red 3	Philadelphia & Matawan	4,000	6,000	Southb'd
Green 5	Ambrose & NY-DCA Bdry	3,000	5,000	Northb'd
Green 5	Mitchel & NY-BOS B'd'ry			
Red 13	NY-Pitts B'dry & Sellingsgrove	7,000	8,000	Eastb'd
		4,000	6,000	Southb'd
Red 77	Millville & NY-DCA Bdry	5,000	12,000	Southb'd
Red 33	Lancaster & NY-DCA Bdry			

50 Years of Flight

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pellers—these were basic to better, safer flight.

10) *High-octane fuels*—these were vital in the successful growth of high-performance aircraft.

Ralph Damon, *Pres., TWA.* In the rapidly changing dynamic field of aviation, it is quite a task to forecast developments for the next 10, 20 and 50 years.

However, I believe we shall see great development over the next 10 years in turboprop and turbojet aircraft—each type being used in its best economic range—while piston engine-powered aircraft will continue in operation in commercial transportation.

Helicopters also should emerge as practical workhorses in the short-haul and local-service range.

In view of the order of design problems to be solved for the convertiplane, it may be 20 years before they are in medium-range service.

Atomic powerplants are still some distance away, although special applications of atomic power may appear in air transport within 20 years.

Commercial air-transport powerplants will grow larger, and the size of commercial aircraft will gradually increase during the next 20 to 30 years.

The trend toward big fuselages and small wings will probably continue, and considerable advancement in the design of transport ground facilities should be seen. Very considerable improvement in flight dispatch and control through improved electronic aids also will be evidenced within the next 20 years.

Certainly during the next 50 years we should see automatic flight control devices which will successfully integrate the complex and interrelated flight-path problems along airways and in busy terminal areas during inclement weather.

The next 30 to 50 years should see development of aircraft which are largely impervious to meteorological conditions and which will function with on-time reliability regardless of these weather factors.

We can look forward in the next 50 years to tremendous technological gains in the science of air transportation. These gains should result in increased reliability, safety and efficiency—and in far greater public acceptance of air travel.

Looking back over the last 50 years—the first phase in the Age of Flight—many great developments helped achieve for us the great technological strides we already have made, and have indicated the direction in which we now travel.

In my opinion, the 10 most important developments in the first 50 years of aviation are:

1) Internal combustion engine making powered flight possible.
2) The first powered flight.
3) High octane fuel permitting today's efficient airplanes.
4) The establishment and development of airports, airways and electronic aids.
5) Instruments for instrument flying.
6) Airmail under private operation.
7) Skin stressed metal construction.
8) Transoceanic flying.
9) The jet engine.
10) Breaking the sound barrier.

Ralph Damon

Adm. Ramsey

Admiral DeWitt C. Ramsey *(USN—Ret.) Pres., AIA.* Easily within the clear memory of my generation is the entire history of powered flight, from the Wright brothers' creation of wood and wire to the tremendous transonic and supersonic developments of today. Greater than the fact that aviation has grown into one of the world's most dynamic influences in so brief a span is the acceleration of invention—the rising tempo of group development which has produced in a decade things that never found their way into our dreams a relatively few years ago.

Knowing this, as we stand on the threshold of what we believe will be an even more promising future, one is conscious, nevertheless, of the perils of prognostication. Accomplished facts of today would have been regarded heretofore as only extravagent fantasies. Who, then, can tell the future of aviation?

Yet if we only project the development curves of today, we come upon some astonishing things without ever presuming to forecast any revolutionary principles yet to be discovered. Only to this extent, then, do I presume to predict some of the achievements of the future.

Broken, as it first was in 1947 by an American plane, the once-dreaded sonic barrier is no longer a mystery. A research plane has traveled 1,238 mph. Others are being readied to travel over 1500 mph. We may confidently expect speeds of 2,000 mph and far greater. Power for such things is in sight; the greatest obstacle is materials to withstand the terrific heat generated by such speeds, but progress in materials development looks now toward lighter, more heat-resistant substances.

It has already been proven that airplanes can take off, fly a course and land at an appointed destination without human hands touching the controls. Application of this principle to both commercial and military aircraft in the future appears certain, with crews merely monitoring the flights. Indeed, crewless bombers (or guided missiles) are an established fact and are in production and use. Manned interceptors are now able to track a flying target, lock onto it in course and shoot it down without the pilot ever seeing his target. Electronic devices are already taking over much of the work of the transonic and supersonic pilot. Unerring flight and landing by passenger liners on automatic controls is only a matter of time.

Jet and turboprop transports are already in use. Ultimately, turbine engines will power nearly all of the passenger lines, and the fast, low-vibration luxury of jet travel will be common.

I consider it safe to predict that sometime in the near future we will travel by atomic-powered aircraft. Research is already advancing toward such an achievement. It is only a matter of time and development—of patient building on what we know. When that time comes, aircraft will be capable of flying tremendous distances without refueling.

It is not difficult for the whole world to realize the great potential of the helicopter. This amazing vehicle has captured the fancy of the people. The airlines are studying it as a possible answer to short-haul and feeder-line service, and the prospects of extending such service to thousands of communities not presently served by the airlines are good indeed.

On the less spectacular and more immediate side of aviation development, I am confident that there will be a great surge in air freight as the inherent economies and efficiencies of this mode of transportation are realized by American business.

I look for all first-class mail to travel by air. A start in this direction has been made. I believe more and more businesses and industries will operate their own aircraft for economy, convenience and advantages in competitive position.

These are only a few things that are clearly visible as we enter the second half century of powered flight.

Dr. Hugh L. Dryden, *Dir. NACA.* It is a fairly simple task to predict the significant developments in aviation in the next five years, for those which will appear to the public eye during that period are already well under way.

When, however, we attempt to look beyond the completion dates of present projects, there is neither a scientific nor a logical basis for extrapolation. The distant future is dependent on discoveries not yet made and perhaps on ideas not yet thought of by anyone now living. Hence, prophecy becomes an exercise of imagination and faith conditioned by the pessimism or optimism of the prophet.

The story of aeronautical development has been one of ever faster, ever higher, and ever larger aircraft. We expect these trends to continue for some time. The limits of size are set by considerations of practical utility and cost rather than by technical problems. The size may not increase much until nuclear powerplants suitable for aircraft application become available. The speeds of military fighter aircraft are already in the lower supersonic range at moderate altitudes. We may expect the bombers and transports to follow with some time lag. Certainly within 25 years we may have supersonic airliners if we want them. Probably transport speeds greater than 1,000 mph will yield little added benefit to the passenger, but the military demand for a speed superior to that of enemy aircraft will continue. I am confident that the problems associated with aerodynamic heating can be solved.

Within the next few years turbine-driven propellers will receive a thorough practical trial. In the long run, however, the turbojet engine will be the predominant power-

plant. The helicopter will for a time flourish as a short-range transport. I expect that the problem of vertical take-off will ultimately be solved by some clever development of jet or ducted fan engines and that the helicopter rotor may, like the propeller, disappear within 50 years.

We have now operated research airplanes briefly at an altitude of 80,000 feet and the *Comet* jet airliner cruises at 40,000 feet. I would expect operating altitudes to increase continually, since the fuel cost for a given trip decreases with increasing altitude, if combustion efficiency is maintained. Certainly within 50 years we shall be able to operate at considerably higher altitudes. It is very probable that we shall in this period begin man's experience with travel outside the earth's atmosphere after solving the problem of safe return. Whether man will travel as far as the moon within this period is at present unknowable.

The 10 developments which contributed most to the advancement of aviation in its first 50 years are:

1) The Wright airplane
2) Aileron control
3) Unbraced cantilever monoplane
4) Air-cooled engine and cowling
5) Slots and flaps
6) Variable pitch propeller
7) Jet engine
8) Autopilot
9) ILS blind landing system
10) Lifting rotors

Dr. H. L. Dryden

Igor Sikorsky

Igor I. Sikorsky, *Engr. Mgr., Sikorsky Aircraft.* The history of flying undoubtedly dates back centuries before the actual "great event" took place. Among the multitude of names and events that could be mentioned, we point out Ader of France and Hiram Maxim of England, who undoubtedly demonstrated the possibility of mechanical flight but failed to make a craft controllable, and also Lilienthal who created a controllable glider.

Of course, "the event" in the history of flying remains the development of the craft which made the Kitty Hawk triumph possible. It would be difficult to single out a few other further developments because the progress of aeronautics was due essentially to the vast developments resulting from the study and frequently magnificent work of a large number of organizations and individuals in the design and construction fields and of outstanding pilots whose brilliant achievements crowned the efforts of designers and focused attention on and further encouraged the progress of aeronautics. In this respect, the flight of Bleriot across the Channel in the Summer of 1909 and the flight of Lindbergh across the Atlantic 18 years later, represent important landmarks testifying to the progress in all branches of aeronautics which made such flights possible.

From among the multitude of other developments of a later period, two are pointed out, both of which are connected with the removal of limitations in operating speeds which were frequently taken for granted for the flying machine. With respect to the lower speed, the advent of the helicopter eliminated all former notions of minimum speed and consequently take-off and landing distances required. The helicopter with its ability to take off and land direct, as well as to hover, opened a new era of usefulness, both in military as well as in peacetime service.

On the other end of the speed range, the arrival of jet—and later, rocket-driven aircraft, allowing man to travel at the velocity of a cannon shell or revolver bullet and opening the road to space travel, may be regarded as one of the most spectacular and brilliant achievements of human genius of our time.

Forecasting the future of aviation represents a difficult problem because the development would depend greatly on the general situation and the ability of mankind to preserve our civilization and to continue the present rate of progress. However, further expansion in all branches

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Note to dreamers re Dreams #25-36:
They're comin' up—our third dozen dazzlers to decorate the dreams of dauntless aeronauts who've written in from Uranium City to Pakistan, from Korea to West Berlin, from plants and airports in every blessed corner of the good old USA. These vision-conjuring concoctions of ours have attracted such a following, we couldn't stop 'em now even if we wanted to. Besides, who wants to? Meantime, while we select another dozen Dallas dolls, we suggest you reflect on the 12 dreams just past, some of the better points of which bubble about this page. Just for auld lang syne, the "composite" FACTS & FIGURES girl of 1952-'53 was 20, 118 lbs., 5'5½", blue-eyed, and brownish-blonde. For a date with her supersonic sequel, stay tuned to this magazine.
Southwest Airmotive COMPANY
LOVE FIELD DALLAS
Dream-Lovers' Special—Free on request, a 12-girl FACTS & FIGURES portfolio. Limited supply available while it lasts.

50 Years of Flight

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of aeronautics may well be expected. Very soon there will be no place left on the earth which cannot be reached within three or five hours of travel. Large passenger- and cargo-carrying helicopters operating between centers of cities could render valuable services and greatly reduce present-day traveling time. Helicopter transportation will cause new communities and new places of business, industry, recreation, etc. to spring up.

Finally, rocket-driven aircraft will soon start exploring space above the atmosphere, first by jumping out of it and returning in a gliding flight and then gradually extending such flights. Within the coming 50 years the moon and planets may perhaps be approached and possibly landed upon. However, a number of problems must first be solved before such feat is attempted, but with the rate of progress during the past 50 years there are good chances that the next 50 years will solve these problems.

Even on the basis of present factors, methods of power production, etc., the coming half century may produce astounding and interesting developments. Yet, however, should some radically novel methods be discovered, even more brilliant developments may result, provided, of course, mankind does not use such developments for arresting and largely destroying the present civilization, which fact is not impossible. All we can do is work and hope for the best.

C. R. Smith, *Pres., American Airlines.* The path that commercial air transportation will take in the next half century is, I believe, sufficiently well indicated so that we may make some statements about its future without erring either on the side of conservatism or over-zealousness.

In the next 50 years—certainly by the year 2,000 and probably much before that—air transportation will be the safest form of transportation. The intensive efforts of all the schedule airlines to achieve and maintain the very highest safety standards, their impatience with anything less than that, and the inherent advantages of altitude combine to sustain this view.

Virtually all long-distance passenger travel will be by air. There are any number of factors that justify this assumption, but probably the most important of these is, simply, that for the passenger, air transportation is significantly more economical.

As for the mail—all of it, with the obvious exception of local mail, will be carried by air. Along with carrying most of the mail, the airlines also will fly the bulk of other high-value cargo.

There has been a great deal of speculation about jet, and about the speeds that commercial planes will attain. I think that we can expect to see this happen: the multi-engine helicopter will become the chief means of transportation for short distance travel. An airplane resembling the conventional jet transport will be used for the longer distances.

Speeds beyond the speed of sound will rarely be used in civil aviation. They lack economic justification. It is likely, instead, that speeds of commercial aircraft will find an effective middle ground—a sort of "plateau" area between 500 and 600 mph.

The Douglas DC-7, which American already has put into operation on its routes, is the last of the conventional piston-powered aircraft. The next phase in the evolution of the aircraft powerplant—the turbojet and the turboprop—already is with us.

But sooner or later, an engine more effective than either of these will be developed and will become the principal source of power. At the same time, we conceivably may see the creation of a fuel that will have a greater energy value per pound than gasoline, and that will substantially speed-up the trend toward greater carrying capacity and economy.

It is extremely doubtful, however, that there will be any widespread use of "atomic" power in civil aviation—at least, within the next 50 years. Such problems as the weight of protective shielding and the inherent danger of nuclear energy would have to be solved first, and they are, at this point, still remote from solution.

C. R. Smith

O. P. Echols

Oliver P. Echols, *Pres., Northrop Aircraft.* All through the ages man has been imbued with the desire to fly. In 1903 when the Wright Brothers made their flight at Kitty Hawk, this event received relatively little attention throughout the world and few recognized its significance. Those scientists and pioneers who were engaged in the development of flight dreamed of it primarily as a means of transportation which would better the life of mankind.

During the first 50 years of flight, the tremendous pressure of two world wars accelerated aviation progress to many times its peacetime rate, and peacetime aviation was quick to make use of war-developed innovations.

We should examine the future mindful of the lessons of the past. Predictions are risky but, generally, it seems reasonable to believe that the first and greatest progress will be made in the fields where a real need exists.

I hope that the real needs of the future are those of peace. I feel that the advancements of the next 50 years of aviation will include:

1) Turbojet-powered air transports traveling regularly scheduled routes and reducing greatly the time needed for long-distance travel.
2) Ultra-high-speed special-purpose aircraft for transport at times when the higher cost of supersonic travel is justified.
3) Atomic-powered aircraft, but only in sizes capable of carrying the necessary shielding.
4) A successful convertiplane—a personal flying vehicle combining the vertical-rising ability of the helicopter with the forward flight advantages of conventional planes.
5) New materials continuing the progress which has produced such things as the titanium, aluminum and plastics developed in recent years.
6) Further refinement of the automatic flight aids now available, with emphasis on devices which improve safety and advance reliability by permitting operations beyond present limits of weather.
7) Further development of aviation-spawned electronic computing and control equipment, perhaps even into the automatic factory to bring increased production at lower costs.
8) Refinement of new fuels of high thermal efficiency, such as boron.
9) Unmanned automatically guided transports to carry mail and freight at ultra-high speeds.

Looking back on the first 50 years of powered flight, my list of the oustanding developments includes:

1) The Wright Brothers Kitty Hawk airplane.
2) Reliable high-powered gasoline engines.
3) The all-metal aircraft, simplifying the clean, cantilever monocoque construction needed for high speeds.
4) Long-range bombers, such as the B-17 and B-29; and economical transports (Boeing 240, Douglas DC series, and the *Constellation*).
5) The controllable-pitch propeller.
6) The application of electronics to aviation, including radar navigation and landing aids.
7) The gas-turbine engine.
8) Pressurization methods, making possible flights into the stratosphere.

Dr. C. C. Furnas, *Director, Cornell Aeronautical Laboratory.* With considerable trepidation, I have jotted down my thoughts on the most significant items in aviation—past and future. Here, then, are one person's honest, though perhaps not defensible, ideas.

Past 50 Years

1) The Wright brothers' systematic acquisition of basic aerodynamic information. *a)*
2) An adequate and comprehensive wing and boundary layer theory. *a)*
3) Lightweight reciprocating engines.
4) Aircraft gas turbines for both turbojets and turboprops.
5) The automatic pilot.
6) Instrument landing system.
7) Radar, including adaptation to GCA.
8) High octane fuels.
9) A practical helicopter.
10) First supersonic airplane—the X-1

[*a)—These two items are not "developments" in the narrow sense. They are, however, significant and should be included.*]

Next 50 Years

I—Speed

A—Military combat.

Flight speeds will be up to Mach 2 for inhabited aircraft, Mach 4 for airborne guided missiles, Mach 20 for ballistic missiles or space ships.

B—Military—personnel and cargo.
Same as Commercial (*see below.*)

C—Commercial, including Executive Type.
Six hundred miles per hour for long-distance transport; 200 mph for helicopters for short hauls. Because of the economic penalty involved, I doubt if we will have supersonic transports.

II—Automaticity

A—Military combat.
There will still be a few combat airplanes armed with guided missiles with men on board, though these inhabited aircraft will probably stay well back from the target area. Control, including take-off and landing, will be almost completely automatic. Men will be used only where tactical situations call for a high level of judgment.

B—Military—personnel and cargo.
Same as Commercial.

C—Commercial and Executive.
Completely automatic flight control, including take-off and landing, will be available and often used. Flight under zero-zero conditions will be routine. Reliability of schedules will be 99% plus.

D—Private.
Semi-automatic flight equipment will be available but not to the degree in commercial use. Only moderately dependable schedules can be realized.

III—Extent of use of Aircraft.

A—Military.
There is no basis for making predictions. The use will depend entirely on the international situation, and that no one can foretell.

B—Commercial.
There will probably be a 600 to 700% increase within the next 50 years, *i.e.*, about 100,000,000,000 passenger miles per year in the U. S. Throughout the world there will be a trillion passenger miles per year or more.

C—Executive Type.
The use will increase in about the same proportion as for commercial planes, but will remain less in total volume.

D—Private.
There will be a substantial increase over the present, but nothing astonishing. Private use will remain minor compared to commercial operations.

IV—Powerplants.
The gas turbine will have taken over completely. The ducted fan, or by-pass engine, will be the principal propulsive device. Efficient jet devices (probably modified pulse jets) at the rotor tips will be the basic powerplants for helicopters. Nuclear powerplants for aircraft will be confined to limited military applications.

V—Fuels.
Semi-synthetic fuels with increased calorific values will begin to come into use. This will extend practical operating ranges quite substantially.

VI—Safety and Comfort.
Practically all rides will be comfortable and safe. The commercial fatality record will decrease by at least tenfold below the present figure of 0.8 fatality per 100,000,000 passenger miles. Cabin pressurization will really work satisfactorily and gust alleviators will smooth off the bumps.

All in all, it will be a very interesting and fruitful half century.

Dr. C. C. Furnas

M. I. Peale

Mundy I. Peale, *Pres., Republic Aviation.* When aviation attains its centennial, many of the stirring accomplishments of the 50th anniversary that we are now observing may seem like the first, faltering wing beats of a fledgling bird.

For man has now truly learned how to fly—and he will learn to fly even more skillfully and unbelievably in the future.

Along the vista of the past half century are monumental markers of progress. Flight by man was first. Then followed a bewildering procession of developments.

Opinions will inevitably vary as to their proper order of importance.

No one, however, can fail to recognize one momentous development.

Aviation has changed the entire concept of war as mankind fought it for thousands of years, recorded and unrecorded.

The mounting of the first machine gun upon an airplane, the dropping of the first bomb from an airplane, the launching of the first torpedo from an airplane, the first flight of an airplane from the deck of a carrier, and the sinking of the first battleship by a bomb dropped from an airplane—these things surely marked the end of a bloody epoch, only to usher in a bloodier. It is grimly foreshadowed by the production of smaller nuclear weapons which can be carried by very small, very fast aircraft.

On a brighter side of the ledger, the inauguration of regular air transportation which now extends to all parts of the world, the pioneer carrying of mail by air—these leveled in an instant great barriers of time and space—but only after many brave men and women had fought and often died to bring it about.

In the immediate and distant future, progress will be even more spectacular.

Jet propulsion has already become commonplace. The sound barrier has been breached; the thermal barrier will also be surmounted.

New alloys of surprising strength will be forged to enable strange new planes to speed through the outer reaches of the atmosphere at Mach ratings treble and quadruple those of our fastest jets.

The shapes of wings to come may bear little resemblance to those we know today.

New forms of propulsion are already being developed and will be used. Atomic propulsion is a certainty. Perhaps it will carry man through other barriers that will be encountered in space—barriers about which we know as little today as we did of the sound barrier only 10 years ago.

But as we peer out into futuristic space, we should not entirely discount the accomplishments of the past and the present. The propellor is not turning for the last time in the face of jet competition. It will survive, not only on helicopters but also on many types of turboprop aircraft that may solve the problems of getting quickly and economically over what may then seem to be relatively short distances. Nonstop jet flights around the world can safely be wagered upon. The spanning of oceans in minutes instead of hours is foreseeable. The airplane can well become a personal tool, as ordinary a part of daily life for the ordinary mortal as the automobile.

On the other hand, flight will increasingly become more automatic, especially at the very great speeds and high altitudes where human thought fails and electronic brains take over. Arsenals of the world will be increasingly stocked with guided missiles and pilotless airplanes.

Many of these mechanical devices conjure up nightmares of automatic destruction, with mankind cowering in caves.

But of one thing I am certain. Man who has found his wings can meet these problems and match them. Man, having learned to fly, will always love to fly.

W. A. Patterson, *Pres., United Air Lines.* Long-range prophecy is a risky thing in any business and particularly in aviation where yesterday's "impossibilities" become today's realities and where the best-laid plans can be upset so swiftly by technological, economic, social and political forces. Nonetheless, I am willing to venture a few guesses as to the years ahead on the understanding that I lay no claim to accuracy as a crystal gazer.

We know, of course, that we are on the threshold of the jet age. We expect that, by 1958 or 1960, we will see jetliners in regular commercial service. We think they will cruise around 550 mph, cutting present coast-to-coast travel time almost in half. By 1975 or 1980, we probably will see jet speeds at 1,000 mph or so, enabling passengers to leave New York at 12 noon, EST, and arrive on the Pacific Coast at the same hour—PST, of course.

For the immediate future, I think we can expect an increasing use of helicopters for short-haul work—between cities 50 to 75 miles apart as well as between airports and city centers. We can expect a continued and increasing penetration of the first-class inter-city travel market which, in 1952, saw the domestic airlines accounting for about 55% of such traffic. With our expanding air-tourist services, we also should see a gradual penetration of the coach market.

The steadily growing airline fleet, along with increasing public acceptance of air

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travel, should enable us to almost double our passenger traffic by 1960. And I believe we can expect that all first-class mail moving over 400 miles will take to the air. A step in this direction is the experiment which four of our lines now are conducting with the Post Office Department in transporting first-class mail between Chicago and both New York and Washington.

It would be a brave prophet, indeed, who would attempt to envision the aviation picture by the year 2000. Perhaps by then we will have atomic power and another new aviation era will be in the making.

SKYWAYS has requested that I list what I regard as the 10 major developments in aviation over the past 50 years. Inasmuch as commercial air transportation is only a little over a quarter-century old, my list will cover only that period:

1) The over-all development of the art of flying, from the open cockpit, single-engined, 90-mph planes first used in commercial airmail service to the four-engined, 300-mph transports now flying our routes.

2) Commercial application of the airplane, as demonstrated in 1952 when the domestic scheduled airlines flew more than 12 billion passenger miles with some 24 million passengers, 69 million ton miles of airmail and 159 million ton miles of cargo.

3) Attainment of self-sufficiency by the air transport industry, as evidenced by the fact that more than 98% of all mail carried by domestic scheduled airlines now is free of airmail subsidy from the government; that the Post Office receives approximately $1.72 in revenue for every 45 cents a ton mile paid to the airlines which receive only a service rate.

4) Passage of the Civil Aeronautics Act in 1938 which laid a pattern for the sound development of commercial air transportation under an agency independent of other forms of transportation.

5) Stimulation of aircraft development during World Wars I and II.

6) Two-way radio communication between planes and the ground.

7) The full-feathering, reversible-pitch propeller and all it has meant to airline safety and operating efficiency.

8) Cabin pressurization, a major contribution not only to passenger comfort but to high-altitude, multiple-route flying.

9) Development of airway and airport aids such as ILS, GCA, high intensity runway lighting, etc.

10) Powerplant development which has seen us progress from the 200-hp engine of the first commercial airmail plane to the 3,250-hp compound turbine engine of the latest commercial transport.

No list of 10 developments for the past 50 years could be complete, however many could be listed. They all add up to the fact that we have come a long way, indeed. We have much further to go. The many challenges and opportunities which lie before us must give us both a feeling of great confidence in the future of our business and a sense of the heavy responsibilities which are ours in making aviation ever more meaningful as a constructive force in this chaotic world.

W. A. Patterson

Gen. J. H. Doolittle

Gen. James H. Doolittle, *Vice Pres., Shell Oil.** Where do we go from here in aviation? What do the projected curves show in the way of prospects and problems for the future?

In the field of military aircraft, there are three new supersonic jet fighters already flying or on the way: the F-100, F-101, and F-102. The F-100, now flying, is the first fighter to exceed the speed of sound in level flight. Earlier fighter planes have crossed the barrier, but only in dives.

The trend in the new interceptor fighter is toward more and more electronic equipment. With the F-102, we will achieve a plane in which the pilot will serve mainly as a monitor. He will handle the plane at take-off. Then a man on the ground will guide it electronically to the vicinity of the target. Here the pilot will turn a knob, switching control from the ground to automatic instruments in the plane. These will track the target, aim the weapons and discharge them within proper range. Then the pilot will turn the knob again to ground control and the plane will fly back to the base, where the pilot will take over and land it. It is obviously only a step then to the pilotless, fully automatic, supersonic interceptor.

Beyond the piloted planes come the guided missiles. They will, for most military purposes, eventually replace the military airplanes.

In the field of intercontinental ground-to-ground missiles, investigations are covering the speed range from subsonic through ballistic—that is, from speeds slower than that of sound to speeds many times as fast. Accurate guidance over long distances poses an extremely difficult problem. Another and more difficult problem concerns the thermal barrier. A ballistic missile traveling about 20 times the speed of sound would, on re-entering the earth's atmosphere, generate temperatures in the order of 15,000° F—far higher than any temperatures ever achieved on earth except in an atom bomb. No known material can long withstand such heat.

A great deal of work remains to be done in developing adequate materials and temperature control, as well as in extending present range and accuracy of missiles.

A third effect of very high speed has even more bizarre implications. The velocity of a guided missile must be kept under control. If it exceeds some 15,000 mph, centrifugal force will begin to over-balance the pull of gravity and the missile will not come back to earth. It will remain in space and probably become a satellite.

The prospects for civil aviation in America during the next 10 years can be summed up quite briefly. The last of the large piston-engine transports now on order will be delivered from 1954 through 1957. These will be mainly DC-7's and *Super Constellations.* There may be additional future orders placed for these aircraft, but it is not expected that new piston-engine models of large transport aircraft will be designed and produced.

Although there still are many problems to be solved, it is a foregone conclusion that gas turbine-powered transports will be in the future picture. They probably will carry from 85 to 100 passengers, fly over 500 mph up to 40,000 feet and have a range, varying with payload, up to 3,000 miles. Since they are expected to cost $4 or $5 millions apiece, it is not likely that more than two or three American designs will be developed. A few may be in limited service by 1960; in wide use by 1965.

The helicopter also can be expected to do a bigger job in civil aviation. With the development of larger helicopters with multi-engine reliability and a capacity of as many as 50 passengers, we can expect to see them taking over much of the work on local service airlines, as well as the taxi operations between metropolitan centers and airports.

Most important for the future of aviation is the continued development of better airport facilities throughout the United States. More than any other factor, they hold the key to the future of aviation.

Aviation's growth will depend on air port facilities, for all the movement must pass through them. If they can handle it easily, they will further the growth. If not, they will constrict it, and constriction of air traffic is already a present danger.

The 10 events and developments which, in my opinion, contributed most to aviation in its first 50 years are:

1) The first powered, controlled flights by the Wright Brothers in 1903.

2) The cross-channel flight of Louis Bleriot in 1909.

3) The trans-Atlantic flight of Cmdr. Albert C. Reade in the U. S. Navy's NC-4 in 1919, which showed the potential of the airplane for intercontinental movement.

4) The New York to Paris flight of Charles Lindbergh in 1927.

5) The establishment and improvement of airports.

6) The development of aids to aerial navigation. This includes well-charted airways, the development of ILS, GCA, radar and other types of equipment for accurate, safe navigation.

7) The jet engine, which emerged as a practical source of power about the time the reciprocating engine-propeller combination was reaching maximum development.

8) Nuclear weapons. These increase the potential of military aviation many orders of magnitude and will stimulate the development of military aviation that will, in turn, inevitably and favorably affect commercial aviation.

9) The piercing of the so-called sonic barrier, which opened the way to far greater speeds.

10) The development of the jet transport for passenger use, which will permit great increases in man's ability to utilize his all-too-limited time and energy for both work and recreation.

** The above is a condensation of a talk by Gen. Doolittle.*

A. E. Raymond, *Vice Pres.-Engr., Douglas Aircraft Co.* Confining my comments to transport aviation, the 10 most important developments affecting this field of aviation in the past 50 years are:

1) The proof that powered flight was possible, *i.e.*, the work of the Wrights and their first flights.

2) The advent of the multi-engine plane, capable of continuing flight with one or more engines dead. After this, it was no longer true that every engine failure resulted in a forced landing.

3) Stressed-skin construction, making possible clean exteriors (aerodynamically) and roomy interiors.

4) The highly perfected air-cooled radial piston engine, the result of great concentration of attention on this type of powerplant.

5) The automatically controllable, feathering, and reverse pitch metal propeller.

6) Wing flaps.

7) The tricycle landing gear.

8) Pressurization, which made it both possible and normal to fly above most turbulence and bad weather.

9) Advanced navigation and communication systems which have made all-weather operation practicable and safe.

10) Modern operational and maintenance techniques, contributing substantially to the present record of safe, regular, and dependable service.

As for the future, I would expect—

1) Turbine-type transports, in due course but not as rapidly as many think; jets for moderate to long ranges and turboprops for moderate to short ranges.

2) Speeds approaching the transonic. Supersonic speeds will not be commercially feasible until some way can be found to bring their cost down.

3) Continued improvement in operating costs but at a slower rate. Future gains will come harder.

4) Increased attention to the control and reduction of noise, which will otherwise reach levels that cannot be tolerated commercially.

5) Use of improved materials, such as titanium, with greater strength relative to weight, low thermal effects, less corrosion, and higher fatigue limits.

6) Little or no increase in landing and take-off run lengths. Aircraft will be tailored to the existing pattern of airports, by and large, but marginal airports will be improved or superseded.

7) Boundary layer control as a practical proposition.

8) Resolution of the present split between first-class and coach service. We are now, I think, in an experimental and transitional stage and the ultimate pattern will depend on the results of current experience.

9) Gradually improving records of safety and reliability.

10) Constantly growing acceptance of air transportation by the traveling public and by the express and cargo shipper.

In other words, I do not think transport aviation is at—or near—a point of stagnation. It still has a great future ahead of it. On the other hand, transport aviation has in its first 50 years reached a very high level of maturity.

A. E. Raymond

Capt. Rickenbacker

Capt. Eddie Rickenbacker, *Chairman of the Board, Eastern Air Lines.* Looking back through 25 years of Eastern Air Lines, from its pioneer origin in 1928 to its present stature as one of America's greatest air carriers, the accomplishments have been many and the progress tremendous. Yet they are nothing in comparison to what the next 10 years should hold for our company, and the airline industry.

Judging from our own development in our first quarter-century, plus the ever-increasing aeronautical and scientific advancements of the "air age" we have entered, I believe that within the next decade Eastern Air Lines will:

1) Operate a fleet of jet passenger airliners which, carrying 80-100 passengers and cruising at 550-600 mph, will make such non-stop flights as New York-Miami and Chicago-Miami in two hours or less.

2) Use giant helicopters for short-haul inter-city service.

3) Surpass the 10,000,000 mark in passengers carried per year.

4) Operate a fleet of all-cargo transport plane, with air-freight approaching passengers-carried in volume and revenue.

5) Land passenger and cargo planes at different types of airports.

6) Provide jobs for between 15,000 and 20,000 employees throughout its greatly extended system.

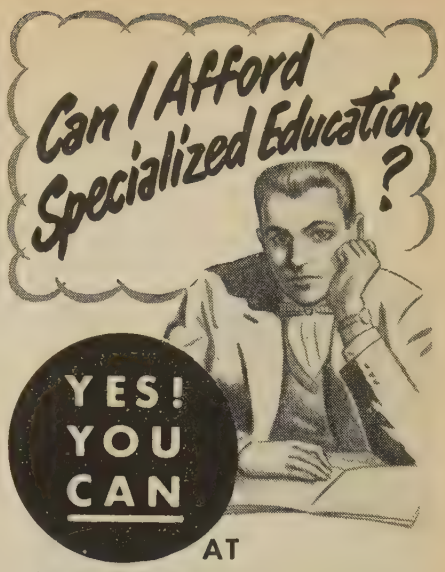
The eventual and certain introduction of jet-powered passenger aircraft is destined to revolutionize the present concept of air transportation in the U. S.

Attainable jet speeds, in the neighborhood of 600 mph, improved comfort advantages, and eventually, acceptable jet transport will hasten the firm establishment of air travel as the universal means for mass transportation. No suitable jet-powered airliner with adequate capacity, range and efficiency characteristics is yet available. Nevertheless, Eastern Air Lines is planning ahead for the detailed transition to these larger, faster transports which should be flying U. S. routes by 1963.

Meanwhile the turboprop powerplant, which we hope will soon be available for commercial use, will replace the engines now driving Eastern's "Silver Falcons" and *Constellations*, thereby providing a bridge into the pure jet period. Then the turboprop engines will come into their own for intermediate city service, increasing present cruising speeds by 75-100 mph. The jets, in long-haul service, will halve the flying time between cities, countries, and even continents.

Helicopters, when developed to the point of economy for commercial use and to cruising speed of 200 mph or better, will automatically become the equipment used

(Continued on page 36)



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50 Years of Flight

(Continued from page 35)

for commuting services between cities up to 300 miles apart. I am reasonably certain that the helicopter, as needed, will be available in varying sizes with 10 years.

It is also essential that we get some manufacturer to produce an all-cargo transport plane that will bring operating cost down to six or seven cents per ton-mile.

All of these developments and opportunities will demand more airports of ample size, especially in and around the larger cities, in order to handle the increased number of planes in airline service. Passenger airports, for instance, will not be used for airmail or cargo carriers, or by private flyers and corporate owners. Ten years may not be long enough in which to complete this division; it will probably take more time and many billions of dollars to finance and build the types of airports needed.

In closing I would like to register the opinion that should the "cold" war last another five or 10 years, or should it develop into a "hot" war, the possibility of atomic power for air transport will be considerably advanced, although most likely not for civilian use.

E. H. Heinemann, *Chief Engr., Douglas.* The 50th Anniversary of Powered Flight is certainly a momentous occasion, as never before in history has so much progress occurred in a single field during a 50-year span, nor has any science had such a far-reaching effect upon the lives and habits of people.

Perhaps foremost in the developments contributing to aviation advancement has been the science of aerodynamics and wind tunnel testing. We would have made little progress without them.

The development of high-strength lightweight and corrosion-resistant materials has accounted for rapid advancement in structural design which, in turn, has made the airplane economically sound.

The constant improvement in propulsion systems, increased knowledge of thermodynamics and the advent of jet engines has been of prime importance, as power availability, especially in recent years, has set the pace in performance progress.

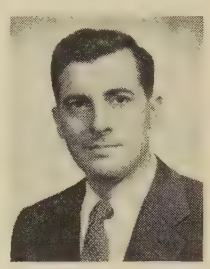
In addition to the airplane proper, the equipment developments have been most significant, for without the developments in the fields of instrumentation, communication, radar, GCA, cabin pressurization and many other items of equipment, the airplane could not have achieved its present state of reliability and safety.

These developments have resulted in an industry that is perhaps the world's largest, and a means of transportation that last year carried 45 million passengers a total of 24½ billion passenger miles.

The future will continue to see similar advancements. Jet transports flying at 600 mph are certainly to be expected. Military airplanes flying faster than sound and missiles traveling many times faster than sound are already at hand. The future appears unlimited with the exception of the aerodynamic heating problem which will limit speeds in the atmosphere, but should Man's desires urge him to find ways of flying faster, he will develop machines to fly above the atmosphere where speed is unlimited.

The record of the recent wars and the intervening years of peace has clearly indicated that aviation is one of the strongest influences in our future security and economy. It is hoped that continued intelligent use of the science of aviation will be a great and beneficial influence in shrinking the dimensions of the earth and bringing about a greater understanding among people and nations, toward an age where man may be assured of a peaceful and still higher level of living.

E. H. Heinemann



Wm. B. Bergen

Wm. B. Bergen, *Vice Pres.-Operations, Glenn L. Martin Co.*

It is obvious from the most cursory analysis of the aeronautical accomplishments already made that the greatest advances have been in times of national emergency, with aeronautical development lagging during periods when America was relaxed in the belief that she was secure from outside threats to her way of life. This is not to argue that the continued rapid development of aviation depends on future wars or even upon the twilight-zone cold war tension in which the world has been living for several years. It is to say, however, that the rate of progress in the future will be determined, not by our technical capacities but by the demands that are placed on our ability to produce better and better air vehicles.

One development that does appear certain is a practical aircraft engine utilizing atomic fuel. Such an achievement would rank with the invention of the airplane itself, since it would, for all practical purposes, free aircraft of range limitations in much the same way that turbojet and rocket engines have wiped out speed limitations to the point where human rather than mechanical durability has become the designer's controlling factor. Interestingly enough, the chief road-blocks to aircraft atomic powerplants are not the problems of transforming atomic fuel into propulsive energy but the secondary ones of weight and protective shielding.

In commercial aviation, the greatest future development probably will be in helicopters and convertiplanes for short-range transportation and in the gradual introduction of jet airliners on long-haul routes. The greatest single increase in the use of aircraft undoubtedly will be in the business use of non-airlines flying—in so-called executive airplanes. Here the potentialities of the airplane as an economic necessity are just beginning to be recognized.

The most advanced developments, of course, will continue to be made in the field of military aviation because of the life-or-death atmosphere surrounding international air power competition. In many categories, such as bombardment, interception and attack, the guided missile will first supplement and then—in certain instances at least—completely replace manned aircraft. Perhaps the greatest progress will come, not in the external form of such craft but in their wedding with functional bombing, navigation and interception systems.

Inevitably, in any discussion of flying's future, the question of inter-planetary travel arises. Here again, there are really no insurmountable technical barriers. To achieve this goal, however, would require a tremendous amount of technical engineering; whether we have a space ship in 10, 20 or 50 years depends only on the effort we devote to the problem.

In appraising aviation progress to date, it seems to me that the following 10 developments, listed in their order of importance, have contributed most to the advancement of man's present mastery of the air.

1) The Wrights' invention of the airplane.
2) All-metal aircraft.
3) Electronic navigation aids.
4) Jet engine.
5) Transonic aero configurations.
6) Constant speed prop.
7) Gyroscopic flight instrument including automatic pilot.
8) NACA cowl.
9) Turbo-supercharger.
10) 100 Octane fuel.

William Littlewood, *Vice Pres.—Engr., American Airlines.* We can be fairly definite about important airplane developments over the past 50 years and can look forward with some certainty to the next 10, but anyone who claims accuracy beyond that time is more than an optimist.

First, a listing in the order of importance (in the author's opinion) of the 10 most significant areas of development of the past 50 years—failure in any one of which would have made the over-all accomplishment impossible.

1) Flight and ground stability and control.
2) Propulsion units of all types.
3) Propellers.
4) High-lift devices.
5) Structures.
6) Instruments.
7) De-icing.
8) Electrical equipment of all types including communications.
9) Hydraulic equipment.
10) Navigational equipment and systems.

As to the future, I believe we can look forward confidently to the accomplishment of all-weather operation.

We can also expect further expansion of the speed range with lower take-off and landing speeds in spite of greatly increased operational speeds. In this field we may well expect the introduction of boundary layer control.

We may anticipate a substantial increase in operating speeds and ranges and modest increases in altitudes. This will be accomplished by aerodynamic arrangements and improvements in stability and control. It will also be aided by the development of

more efficient propulsion devices and fuels. In the extremely long-range view, we may some day anticipate the application of atomic energy to aircraft propulsion, with its almost unlimited range possibilities. We will certainly find continuous improvements in materials of construction and in their application and use.

Coming back to the near future, we can certainly hope for developments in the reduction of noise, both external and internal, although the former presents a much more serious problem.

We can certainly expect that the great preponderance of propulsion units will be of the turbine type, whether they be turbojet, turboprop or ducted fan. We can forecast safely substantial development in the helicopter and convertiplane fields with all the ramifications between those two.

If we look at the operating side of the business, we can certainly expect lower unit costs in spite of safer, more comfortable and faster services rendered.

And, if we wish to look at the very far end of the next 50 years, I think we will find people still talking about trips to the moon.

Wm. Littlewood

E. G. Stout

Ernest G. Stout, *Staff Engr., Consolidated Vultee.* During the past 20 years, the aviation sciences have developed into many highly refined and specialized branches, and it becomes impossible for a single individual to foresee where these many and varied developments will lead specifically in the next two decades. However, it is possible to predict, with a reasonable degree of accuracy, certain broad trends in development that should become commonplace in this span of time.

I believe the greatest development in commercial aviation will be the bulk transport of aerial cargo. I feel cargo aircraft of at least 1,000,000-pounds payload will be commonplace. To my mind, this will be one of the most logical and profitable applications of atomic power to aviation.

Developed as a war necessity, these air-freighters will constitute the aerial merchant marine of peacetime, thereby becoming self-sustaining economically. Due to the great bulk, the necessity for round-the-clock all-weather operation, and vast basing areas, I feel this development will be the great future role of water-based aircraft. Water is nature's ideal support for great loads and constitutes, in most metropolitan areas, the only large, unobstructed areas remaining for such vast expansion of aeronautical activity. With the wide application of atomic power for aircraft, water-basing, with its obvious inherent advantages from the point of view of safety and economy, becomes the logical trend.

Long-range passenger operation will definitely move into the supersonic speed range and experimental inhabited flights to outer space will be accomplished. All intercity transport will be by vertical-lift aircraft operating from mid-town terminals, and aerial taxi service will be commonplace.

From the military standpoint, it appears quite obvious that all aerial combat—both offensive and defensive—will be conducted by uninhabited vehicles except for the inevitable logistics.

To my mind, the following 10 developments, in general order of importance, contributed most to the advancement of aviation during the first 50 years:

1. The internal-combustion piston engine
2. Metal aircraft structures
3. The monoplane
4. Metallurgy
5. Gyro instruments
6. Gas turbine engine
7. The theory of swept wings
8. The DC-1 and subsequent series
9. The NC-type flying boat
10. Pressurization

Luis de Florez, *Pres., de Florez Engineering Co.* How man achieved powered flight and, in the brief span of 50 years, transformed wire and bamboo, kite-like structures into 50-ton aircraft transporting millions of passengers each year is one of the most remarkable accomplishments in the entire field of technology.

Perhaps the most important fundamental influence contributing to the advancement of aviation has been the substitution of scientific methods of test and research for the erratic and hazardous cut-and-try methods of the early days. It has been the application of all our basic sciences plus wind tunnels and accurate methods of testing and instrumentation, which has created the science of aerodynamics.

Our powerplant development gave us reliable air cooled radial engines, along with the variable pitch, constant-speed propeller. It also has given us the gas turbine which has made supersonic speeds possible.

Electronic development has given us radio communications, making possible instrument flight and long-distance navigation, and radar, both airborne and ground, has extended our perceptions.

Driven by the same powerful influence of scientific development which has made them what they are today, aircraft in the next 50 years will increase in size, speed and range. They will be able to fly the stratosphere at supersonic speeds with safety and reliability. They will become increasingly less dependent on fuel stops, due to the advent of new fuels and atomic powerplants.

It is probable that large aircraft will be built as flying boats to offset the complexity and weight of landing gear.

Vertical rising aircraft other than helicopters will be developed with forms and aerodynamic properties better suited to high-speed travel.

The pilot as we know him today will become less important, from an operating point of view, and will be used more for his knowledge and experience than for his manual skills. Pilotless aircraft will become increasingly important—as weapons, cargo and mail carriers.

It seems probable that powerplants will be produced in the next 50 years that will provide us with the means of obtaining greater acceleration than the 7 miles per second required to leave the earth's gravitational pull. We will be able to launch missiles into space and maintain communications with them to increase our knowledge of the outer world.

The second half of the century of aviation will bring magnificent scientific and practical accomplishments, but to the first half will always belong the romance and the fruition of man's greatest adventure —powered flight.

L. de Florez

R. A. Norden

Raymond A. Norden, *Pres., Seabord & Western Airlines.* The growth of the transatlantic airfreight in the past years has changed many concepts in our business life, and there will be more changes as the industry continues to expand.

Since 1947, the first year of transatlantic air-freight movements, when 12.1 million freight ton-miles were lifted, through the end of 1952, when the industry moved 46 million freight ton-miles, the shuttling of freight-loaded aircraft across the Atlantic has more than justified the dreams and expectations of the airline operators. So firm is Seaboard's faith in the future that it ordered four 300-mph *Super-Constallation* air freighters, the first to be constructed for an all-freight airline.

It has been shown by economic studies that approximately 685,000,000 pounds of commercial freight can be attracted to air shipping by economic rate structures. We feel that the impetus derived by the introduction of *Super-Constellation* freighters will see a traffic surge up to 160 million ton-miles on the Atlantic in 1955; to 450 million ton-miles in 1960.

We also believe that a downward revision of rate structures can be economically achieved by a "selective" approach, rather than across-the-board reductions.

The advent of larger freight aircraft capable of lifting upwards of 50 tons across the Atlantic at direct operating costs of less than four cents per mile should generate 1,200,000,000 ton-miles of freight.

For the international air freight field, we feel that the jet commercial transport, presently conceived, is not suited to provide the economic benefits found in conventional aircraft now in production. The next development in powerplants for the long-range freight carriers in our opinion, will be the turboprop-driven aircraft, an adaptation provided for in the construction of the *Super-Constellation.*

(Continued on page 38)

50 Years of Flight

(Continued from page 37)

It should be pointed out that the future of transatlantic all-freight is well demonstrated by the attitude of the British government in its civil air policy as expressed last year in connection with unsubsidized carriers. It said, in part, ". . . we have hopes of independent companies developing the all-freight market, which is a growing field with great possibilities." A few months later, the Ministry of Civil Aviation authorized the establishment of an all-freight service by Airworks Ltd., operating from the British Isles to New York, via Canada.

Truly, air freighting on the Atlantic opens new frontiers for all of us. New production techniques for the aircraft manufacturers, together with revision in operating procedures will be needed in the growth of the industry. All of us in the international air-freight industry are convinced that its horizons are unlimited.

Charles W. Newhall, Jr., *Pres., Flight Refueling Inc.* Ever since aircraft have been designed, built and flown, the problem of providing sufficient range has been one of the aerodynamicist's major headaches, and securing refueling bases for short-ranged bombers has necessitated and justified some of history's bloodiest battles.

For example, the storming of Iowa Jima cost over 24,000 American casaulties but cut down by 800 miles the 3,000-mile round-trip of B-29's. Thus, over 800 fuel-short planes and many lives were saved, thanks to Iwo.

Today, the prospect of non-stop trans-Atlantic jet service presents a serious economic problem, for one half-ton of fuel must take-off with each passenger.

These are but a few instances of why the ability to re-fuel aircraft in flight can be considered one of the most significant developments during aviation's first half century and why in the jet age of the future it will play an even more significant role, both militarily and commercially.

With the development of practical, high-speed, high-altitude, high-volume systems, mid-air refueling becomes an integral part of military strategy. It means more than giving bombers virtually limitless range and fighters greatly increased endurance. It means that a smaller number of aircraft can deliver a larger tonnage of bombs on a target.

The commercial aspects of flight refueling are also promising and should prove of real significance in the future intercontinental and continental use of jet transports. Refueling in flight can mean tripling or quadrupling the percentage of payload and will obviate intermediate fuel stops with resultant better service to passengers, higher utility of aircraft, and less jeopardy to equipment by reducing the number of approaches and landings.

The aviation leaders whose opinions have herein been expressed are practically unanimous in their belief that developments over the next 50 years will equal, technologically, the advancements made during the past 50 years. It is expected that within the next decade all long-range air transports will be jet powered; that speeds will be between 500 and 700 mph; and passengers will number 60,00 0,0 00 a year, more than twice the number carried by the airlines in 1952. The short-haul air routes will be flown by helicopters, possibly turbine-powered, able to operate under practically all weather conditions, with greatly improved electronic aids to navigation, air traffic control, etc.

The majority look to atomic-powered aircraft, particularly military, flying at speeds between 1,000 and 1500 mph within the next 50 years; and guided missiles daily probing the outer reaches of space, previewing, perhaps, the advent of true space ships traveling between planets. The "when" on interplanetary travel may be within this next period of 50 years, but more probably it will come sometime later, according to the majority. Nevertheless, the shape of wings to come by the year AD 2003 promises to be just as gainful, technologically, as the past 50 years have been. As Sir William Hildreth suggested, it remains to be seen if the best in man will overcome the beast in man, and we can maintain a world at peace.

Business Flying

(Continued from page 13)

New York *Daily News*, United Gas System, Crusader Oil, O. J. Whitney Company, Gann Scientific Service, Gannett Newspapers, Gold Seal Bread, Siswein's Furniture Co., Stanovo, Link Trainers, General Tire & Rubber Co., Mayflower Transit Co., Champion Sparkplug, Black & Decker, Automatic Washer Co., B-1 Beverage Co., Pfaulder Co., F. H. McGraw & Co., Reynolds and Parker Pen companies, to name a representative few.

Their equipment comprised just about every type of airplane then manufactured: Beech B-18 and B-17, Bellanca, Curtiss *Robin*, Curtiss *Kingfish*, Douglas *Dolphin* and Douglas DC-2 (first corporate DC), Fairchild 71, 45, 24, 84 and A-942, Fokker *Super Universal* and AF-10, Ford 4, Howard DGA-15, Laird *Speedwing*, Lockheed *Orion*, *Air Express* and 12, Loening amphib, Northrop *Gamma* and *Delta*, Ryan C-1 and SC-W, Sikorsky S-39 and S-43, Spartan *Executive*, Stearman, Stinson M, A and *Reliant*, Travelair, Uppercu-Burnelli, Vultee, Breese, Waco, and Pitcairn.

Executive flying continued during World War II on a greatly curtailed basis, but the war years taught many business men the many advantages of air travel and soon after hostilities ceased the period of greatest growth in the use of aircraft as an integral part of business and industry was launched. And, unlike the post-war boom in personal flying, business flying has not tapered off. It has become the most stable segment of non-airline aviation.

Today, the business fleet comprises more than 10,000 airplanes of all types—more than double the number of aircraft used by all U. S. domestic airlines combined. And approximately 1800 firms are operating multi-engine planes. The spearhead of this vast air operation is the National Business Aircraft Association, formed in 1946 to protect and advance the interests of all business-aircraft users.

These aircraft are used for a score or more of important jobs day in and day out and they are in the air many more hours each year than are our airline transports. Here's a typical example of business aircraft utility:

In 1946, American Rolling Mill Company flew a Beechcraft D-18S 75,000 miles, averaging 20 trips a month. The company's executives completed in one week a tour of ore properties which would have required three weeks by train and car. More recently, the J. R. Watkins Company, flying its DC-3, made a 30-day nation-wide tour with a group of sales personnel, visiting distributors and district managers. From January 1 to May 31, 1952, the Watkins plane was in the air 65 days and flew 163,970 passenger miles.

It is not unusual for a company to own from five to 10 airplanes and several, such as the Texas Company, operate a fleet of 20. General Motors leads the parade with about 25 aircraft, using them to maintain frequent contact with branches and hundreds of suppliers and for many other important business trips.

Yearly utilization is high, averaging over 600 hours per plane per year, but business is not entirely concerned with high utilization. Rather, the business man places more emphasis on availability. To him the airplane is useful, if it is ready to go when he wants to go.

As the largest user of aircraft, American business has pressed into service virtually every type of aircraft, including a few of the larger four-engine planes. Business has become expert at converting these airplanes, all designed for other purposes, to its special requirements. A few aircraft suited to the particular needs of business and industry have been produced since the war, but the demand for still other types is great.

It is conceivable that in the next 50 years business and the aircraft manufacturing industry working together will evolve an entire series of airplane tailored from design to production for business usage.

What of the pioneering companys which saw the usefulness in an airship 48 years ago and put it to work? The answer is that it still is using the airplane. The Charles B. Knox Gelatine Co., Inc., operates a Grumman *Widgeon* (G-44A), with young John Knox, secretary and treasurer and former Air Force instructor, as pilot.

With plants in Johnstown, N. Y., Camden, N. J., and Montreal, Canada, and a selling organization of 108 food brokers, Knox uses the *Widgeon* for general liaison work between plants, sales trips to contact representatives and general executive transportation.

Like his grandfather 48 years ago, John Knox is using the airplane as an effective tool in his business.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

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area where we get our thunderstorms —we have to stay within so many miles and so many minutes of our flight plan. Sometimes you can detour, but you can't do it without causing all kinds of commotion at the radar defense centers.

"I also agree with Marshall Fay on the take-off problem. Sometimes we have to sit out at the end of the runway, gathering snow and what-not, and there should be some procedure for expediting take-off clearances where snow is involved."

Flexible Take-Off Minimums

C. M. Christenson: *"What about reduced visibility in take-off—take-off minimums?"*

Capt. Blair: "A lot of delays are for no good reason. They are actually because the weather observer sees one thing, the tower sees another, and the pilot still another. Take-off minimums should be made flexible so that we can use either one of three people to give us the visibility that we have on the runway. Sometimes take-offs are held up because the Tower and Weather Bureau do not see the visibility on the runway the way the pilot does.

"I've waited at the end of a runway at Idlewild and found the visibility to be a good two miles, and the Tower operator was giving just a quarter-mile. We couldn't operate because the Tower man was reading visibility from his position 200 feet up, just at the base of the overcast, while we were down on the deck. There should be some flexibility in reporting weather so that we aren't held up when we don't have to be."

William R. Strong (*Chief Pilot, National Dairy Products Co.*): "As far as I know, the CAA places no limits on company-plane operations as to take-off. We can take off if its zero-zero, and do so without fear of violation. I recall one day at Chicago when flight operations were very limited. It was cold and snowing. From the Tower, 60 feet off the ground, visibility was really bad, and I fully expected a real zero-zero take-off. But when I broke ground and got the wheels up at an altitude of 75 to 100 feet off the ground, I had a good 3-miles visibility.

"Another time, I was held on the ground at Detroit because the weather was bad at my destination, Cleveland, and the air-carriers were holding at the CLE range station. The weather didn't break, so the airlines scattered to their alternates, and I was cleared to the Cleveland range station. When I arrived over Cleveland, ATC asked if I wanted to make a PPI approach. It was all right with me . . . I had about 200 and ½, but the wind was from the south and that eliminated air-carrier approaches because they make their approaches to the northeast. Anyway, I made the PPI approach and it was a good, safe operation.

"I think the CAA and the air carriers are missing a bet by not taking advantage of the equipment they have available."

Mel Lamb (*Regional Dir. Executive Air Transport Co.*): "Last night I called La Guardia Radar to give us a fix on a heavy thunderstorm while I was coming in from eastern Long Island. The storm appeared to be right over the field. I called in, asked for the position of the storm and its movement in order to decide whether to continue to LaGuardia or go to an alternate. I received an excellent radar report on the storm and was able to get into and out of LaGuardia without any trouble.

"As has been brought out here, in many instances the pilot at the end of the runway can make a better decision as to whether or not he can make a safe take-off and climb-out than can the controller or weather man at the station.

"Radar departures help tremendously, and I also think that the high calibre of the pilots flying business planes or airliners warrants the acceptance of their judgment for such departures. The business-plane pilot has no minimums; the airline pilot has 200 and ½ at most fields; it should be accepted practice for the airlines to accept a pilot's judgment, especially where you have radar departures. It certainly would reduce some of the delays we are encountering in the high-density metropolitan areas."

C. M. Christenson: *"Capt. Doug Sager, we know that fog and reduced visibility as*

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Skyways Round Table

(Continued from page 39)

well as thunderstorms and high winds are a common occurence in your operation. Perhaps you have some suggestions."

Capt. E. D. Sager *(Asst. Chief Pilot, Eastern Air Lines)*: "I don't mean to criticize any agency, but we could stand some education of pilots and the different agencies that control or effect control of flight in its climb. Everybody is interested in on-time departures, not delaying flights outbound, and we do have policies in the Centers and Towers which are promulgated on the basis of safety and not going into border-line operation. However, in the interest of getting aircraft out, there is still a tendency to issue clearances based on words, such as 'VFR through certain altitudes,' etc. Not too long ago, we were given a clearance that was worded to the effect that the pilot was cleared for take-off and VFR from 3,000 to 7,000, and after that back again under a tight clearance. As we all know, weather can change quickly, and then the pilot finds he's not able to VFR. That calls for a quick relay of information to establish the fact that the pilot isn't able to VFR.

"The clearance should be so worded that it would be dependent upon the clearing agency to guarantee separation. We are interested in safety and this is contingent upon a report from the pilot when he *knows* he is VFR. Some pilots see VFR one way, and some another, but the basic part to me is that they should be confident and feel safe within their own limitations on operating conditions."

A. L. Ueltschi *(Pres., Flight Safety, Inc.)*: "I think we should give the pilot the responsibility of taking his visibility reading for take-off. He can see the end of the runway, and that's more important than what the observer might see at his station at the other end of the airport.

"Going into the subject of landing, I think it will be a big help when they put these new ceilometers at the middle marker. After all, we're interested in the end of the runway we're going to land on.

"Getting back to radar departures, at LaGuardia certain operators have been routing some of their traffic around thunderstorms on a climb. Several times I've been cleared out of LaGuardia and routed around the precipitation. I'll also admit there have been times coming in when we've been held in a thunderstorm. I don't think they're going to be able to keep us holding in a thunderstorm at certain times in high-density areas. But there certainly seems to be some improvement, especially at LaGuardia."

C. M. Christenson: *"As Roger Sullivan stated, the reason they keep you outside the storm area is because they can't see you if they get you inside."*

William R. Strong "What happens when you're in a stack? Let's take Flatbush, for example. I'm at 5000 feet; there's somebody below me at 4500 and another guy below him at 3500; and another plane on top of me. Some precip, turbulence and lightning come along, and I'm pushed up 500 feet or more and can't hold the assigned altitude. It is supposed that the pilot of the plane below me is experiencing the same difficulty, but maybe we still have a thousand feet separation. That worries me plenty. I'd like to stick to the altitude assigned to me and you and everyone else does their best to hold there. You fight with power on and power off, and you listen to the Approach Controller and hear some pilot get cleared from 4500. You try to let down but in the meantime you're climbing a thousand feet a minute. The radar operator can't see you because you're in the precip. Possibly, better radar would help under these conditions."

Mel Lamb: "From my observations, I think the Center's thinking is along the lines of 2,000-foot separation under heavy turbulent conditions.

"Also, regarding Capt. Sager's comment about 500 on top or VFR condition determined by the pilot, the Center is more interested in assigning you an altitude and keeping you under control throughout your flight than it is in giving you a 500-on-top clearance. You will have a given altitude in the future, and for conditions of heavy turbulence, I believe they are thinking of 2,000-foot separation."

Roger M. Sullivan: "Not thinking, it's been a fact, a policy for several years. If you do report turbulence of any degree, you are afforded a 2,000-foot vertical separation."

Dispatch and WB

C. M. Christenson: *"Having heard from the operating group, it appears that we have problems associated with thunderstorms in the immediate vicinity of the airport during take-off and throughout the entire climb regime. We have the very real problem of reduced visibility, smoke, fog and other conditions. We have the problem associated with visibility during climb. Perhaps the dispatchers, the Weather Bureau and Air Traffic Control can suggest some solutions. What about that, Max?"*

W. M. Ragland *(Asst. Supervisor-Flight Dispatch, American Airlines)*: "Dispatch problems in take-off and climb weather are principally the same as the pilot's. In the matter of thunderstorms in the vicinity of the airport, field radar, ATC radar or any radar can provide information that would be quite helpful to the pilot. There is a lot of good information that can be obtained from the present radars used for GCA and surveillance, but in most cases you have to ask for it. Once you've asked certain stations to supply the pilot with information, they'll go ahead and do it. I think more initiative can be shown by the man working the radar rather than having to be requested by the man who is trying to dispatch and work out the pilot's problem while the airplane is sitting at the end of the runway. Volunteering some of that information would help a lot, particularly if the thunderstorm is in the vicinity of the airport.

"Snow and ice on the wings are a wintertime operating problem, principally one of traffic control. If they can get the plane off the ground fast, that's fine.

"Ceiling and visibility from the pilot's observation certainly would be helpful and better than what we have now, particularly in those cases where we are going to higher and higher control towers that are more and more on instruments when the ceiling gets down. We're faced with lower and lower visibility reports from the tower men when the man at the end of the runway actually doesn't have a visibility problem.

"The general dispatching angles of take-off in fine weather become mainly those of having and supplying the out-going captain with information on what he can expect, and not only for his trip but for trips an hour or two later. That is purely a matter of taking advantage of present facilities, implementing them with future facilities of greater scope and bigger and better radar, and making that information available.

"The tower may know there is a thunderstorm hidden behind a bunch of stratus, but that information isn't passed on. The airline may know about it, but the information isn't any good unless it gets to the pilots. There could be a lot of improvement along these lines."

C. M. Christenson: *"In other words, that gets around to the problem of communications."*

W. M. Ragland: "We need communications and more initiative on the part of the person who has the information to see to it that info is distributed for everybody's use."

C. M. Christenson: *"Let's catch another dispatcher here. John Burke, may we hear from you?"*

John F. Burke *(Senior Dispatcher, Pan American World Airways)*: "The noise abatement program and the resultant use of preferential runways plus using one runway for inbound traffic and another for outbound traffic has greatly facilitated our operation. A great number of our Clippers are heavily loaded, thus the heat bothers us as much as it does anybody else. While Idlewild's long runways nullify temperature accountability here, we do go into places where temperature accountability is quite a factor.

"Getting away from take-off and climb aspects, a dispatcher's problem is one of pre-planning. Our pre-flight management is one of loading sufficient fuel for the anticipated meteorological conditions the captain is to encounter and still carry committed revenue—passengers, mail and cargo. In other words, we have to load enough gas for the pilot and his 'flight management' and still leave room for revenue.

"Indirectly, we are also involved in the problem of cruise altitude. On many of our non-stop trips to European cities, the pilot achieves the cruise altitude by step-climb, and we enter into the anticipated problem when the pilot is either assigned an altitude he cannot achieve or has to take a lower altitude which would unduly penalize the trip in terms of fuel consumption. Congestion across the North Atlantic, unthought of a few years ago, dictates the assignment of cruise altitude, and the dispatcher has to consider cruise altitude possibilities and temperature accountability prior to the plane's departure."

Norman E. Huseby *(Station Chief Meteorologist, Eastern Air Lines)*: "The prob-

lems of the meteorologist concerning take-off and climb weather are not too different from his other problems. Our forecasts, which are issued 16 to 18 hours in advance, must usually be too general in nature to be of much help in the problems we have been discussing.

"Where there is a load problem, we're asked for a two- or three-hour surface-wind forecast as well as a temperature forecast, but so far these are on a day-to-day basis. We are getting more and more of this, and in the future we undoubtedly will have to make these detailed forecasts many hours in advance. Frankly, there is a lot we don't know about the short-range precision forecasting of these elements, and much has to be done to help us pin down temperatures and the runway wind directions and velocities. I believe these temperature forcasts should be within 2° or 3° and the wind velocities within 4 or 6 mph to be of the desired assistance.

"Thunderstorms, except when associated with fronts or squall lines, are a local problem, and forecasting cannot help too much with the skirting of these thunderstorms during the climb. We can forecast thunderstorms in an area, but to try to pin them down as to exact location is something that has to be done by local radar observation at the time of departure."

R. H. Simpson (*Aviation Weather Specialist, USWB*): "I'd like to endorse Mr. Huseby's comments regarding the difficulty of forecasting the fine-grain structure of weather.

"The meteorologist usually regards the job of weather forecasting as consisting of three parts: 1) the anticipation of conditions which favor the development of certain specific weather conditions, *i.e.* low visibility, low ceilings, thunderstorms, etc.; 2) the detection of the first outbreak of these conditions; and 3) the tracking and forecasting of variations in these conditions, once they're formed. The last two are limited largely by the density of observing stations. We continually get complaints from private pilots that the Weather Bureau provides only 'stovepipe' observations. Unfortunately, this is usually quite true, for without radar to extend one's vision of weather elements, an observation from any one particular point affords an appraisal of conditions within a range of only about 20 miles, and our stations are spaced at much wider intervals than 20 miles. We have an average of one station every 10,000 square miles in the U.S.

"Forecasting the thunderstorm which is hidden from view by a strato-cumulus overcast just outside a terminal is a problem the meteorologist cannot yet cope with. He may forecast the fact that conditions favor the development of a thunderstorm in the area, but until someone spots the thunderstorm or it is picked up by radar, it is impossible to tell the pilot precisely where or whether he will encounter a thunderstorm during his climb-out of the terminal. We just can't tie down our forecasts or our observations of weather distribution that closely. However, the Weather Bureau is looking to the development of more effective and efficient instrumentation to help solve some of the problems, especially in regard to the fine-grain structure of the weather, which is becoming of more critical importance to aviation.

"As mentioned earlier, radar is becoming one of the most important tools in weather analysis and short-range forecasting. The Weather Bureau has been handicapped in its attempt to develop a radar-warning network because of the unavailability of suitable weather-detection equipment at a cost it can afford. Only recently our Instrument Division found a way of modifying certain war surplus radars, which are available in quantity, to make them well suited to weather detection. The modification, while not particularly expensive, provides an effective operating range of almost 200 miles, an output power more than 30 times that of the orginal set, and a beam width of only 3°. This equipment is well adapted to all types of weather detection and should prove particularly valuable in vectoring planes through severe weather conditions.

"At present the Weather Bureau is implementing a radar-warning plan in the state of Texas in which every Weather Bureau station will be equipped with one of these improved radars. The cost of the modification is being defrayed by the communities benefiting from radar warnings of severe storms, and the modifications are being carried out by Texas A & M. If this experiment proves successful and the use of radar effective, the Weather Bureau may be able to arrange similar cooperative projects for installation of radar at first-order stations in other states. We hope ultimately to have radar equipment in every one of these stations.

"Another step we are taking, in cooperation with the ANDB and other aviation interests, is the project at Mac Arthur Field dealing with low-visibility approaches. One important result which this project has brought out is that some of our present concepts of visibility and definitions of ceiling must be revised. The element known as ceiling, particularly with reference to approach control procedures, turns out to be a 'horse of a different color' than was accepted to be the case 10 years ago.

"When ceilometers were first installed some years ago, the vertical-scan instrument was used which provided a measure of the height of cloud bases once every 6 minutes. This instrument drew attention to remarkable fluctuations in cloud-base heights. More recently, the rotating beam ceilometer was developed, providing a measurement every 24 seconds. Even at this interval it was evident that there were rather wild variations in this thing we had been calling ceiling, particularly when cloud bases averaged less than 500 feet from the surface and were critical for an approach to a runway.

"Finally, the ceilometer was speeded up again to provide a revolution every 12 seconds, with a light in either end so that a measurement was made every 6 seconds. Even at that interval variations of plus

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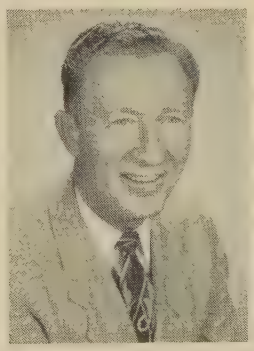

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Skyways Round Table

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or minus 400 feet were detected.

"With such variations as these, it would seem that the only effective way of providing useful information to the pilot during a low-ceiling approach is to place this latest model ceilometer near the middle marker, and by combining information from this instrument with other data from a transmissometer at the end of the runway, tell the pilot at what elevation he will be able to establish threshold contact and maintain it, say 50% of the time."

A. L. Ueltschi: "Generally, when anyone talks about ceiling, he means the top of something. When you mention ceiling to a pilot, it's the bottom.

"The weather observer is affecting our operation to a point where he's an operating man instead of an observer, and the only thing we want from the Weather Bureau is an observation. Our problem is, how low can we safely descend and see enough to make a landing. With this new .406C, the scheduled airlines will be permitted to take a look-see with GCA and ILS, and that should help."

C. M. Christenson: "If we go back *through history, you'll remember we used to land at Salt Lake City in weather that is now considered beyond the realm of capacity . . . and at that time we didn't have radar, ILS, etc. It was no problem then to get down through 75 or 100 feet of fog, but the business has changed. It is being regulated, and it all comes back to who is in command and how much faith and confidence you have in the man in the cockpit.*

"Most important in the long-range planning of trip dispatch is that we must know more about temperature, humidity, probable winds and existing weather at the airport. All of which means precision is being introduced in scheduled operations as well as business-aircraft and private-plane operations. A pilot is becoming more precise in the control of his aircraft; the operator is becoming more precise because it means time, dollars and cents. As a result, we have to introduce more precision into the analysis of atmospheric conditions in order to do a more efficient job of flying the airplane.

"The problem of take-off and climb in reduced visibility means we have more precision in control because of the number of aircraft taking off from airports at the present time. We must exercise better control of take-off routes, separation and communications so that we can advise a pilot that another plane is either taking off behind him or is just ahead of him.

"Once off the ground, we become involved with the enroute weather problem. In this, one of the most important things is, again, communications between the man who forecasts the weather and the man who keeps a record of it in the Dispatch Office and who is in contact with the aircraft in the air.

"Then there's the problem of self-help in the air which involves those important communications that take place between pilots flying trips in the same general vicinity. We must consider this problem because our speeds are going to increase rapidly within the next few years, and the problem will increase or decrease with respect to our ability to anticipate and plan our flight in accordance with existing weather. The thunderstorm or line-squall problem as well as dry-air turbulence, icing conditions, etc., increase with the increase in speeds. The closure rate of two airplanes traveling at 500 mph is roughly 1,000 *mph."*

Capt. Kim Scribner: "I'd like to ask the Weather Bureau a question. Does the forecaster utilize and accept aircraft-reported enroute weather to as great a degree when every aircraft reports the observed weather, or would the forecaster feel the reported weather was more accurately observed if a specific flight was designated as a weather-observing flight?

"We have an ever-increasing number of flights across the North Atlantic, and we are confronted with the problem of communication of reported weather as it is observed by all aircraft vs. the possibility of a specific flight being designated as a weather-observing flight. We think quality of observation would be better than quantity where the forecaster is perhaps discounting the majority of these observed-weather reports."

R. H. Simpson: "I can't answer that on the basis of experience in the Atlantic. We did try that in the Pacific for awhile and had a certain specific flight designated as a weather-observing flight. Our experience was that we were better off when we had every flight report the conditions found enroute. With planes flying higher and higher and being less able to give accurate reports of in-flight winds and where such winds as we do get comprise only zonal components, we feel the margin for error is rather large and, therefore, the only remedy is in a large volume of reports.

"That is the tentative conclusion we reached and we feel that, until we can see a further improvement in accuracy of wind deviations enroute, we should continue to insist upon observations from each plane."

Capt. Kim Scribner: "Based on the frequency of flights across the North Atlantic, our primary concern is with the wind component available for the entire flight across, and that's available because of the frequency of flights. We feel that we would have better observed-weather reported, and would also be relieved of the saturation of our family of radio frequencies available across the North Atlantic. We have the continued problem of relating and repeating messages that we don't feel are of any real value. We'd improve our radio-telephone communications by being relieved of all messages except those operations messages important to us on the airplane."

Circumnavigation and Communications

William R. Strong: "The international problem is one thing, but we're primarily interested in the domestic enroute weather deal as it relates to air traffic control. Perhaps Mr. Sullivan can help us.

"Let's take this for example. Suppose I'm IFR to New York and there's a thunderstorm over Pittsburgh. I want to circumnavigate this disturbance, but with the converging airways in the Pittsburgh area, I hesitate to deviate from my original clearance and conflict with the traffic on another airway."

Roger M. Sullivan: "I'm not an enroute man, but I think it's a matter of requesting a tentative change in flight plan. It's up to the Center and it's based on traffic conditions at that particular time as to whether or not approval of your change would be given."

William R. Strong: "I tell the Center I'm going to be roughly 30 miles away, but I could be a greater distance."

C. M. Christenson: *"Circumnavigation of weather is becoming more and more of a problem. Here again, we have communications involved, the problem of pilot intelligence information received either from the ground through ground advisory or through airborne equipment."*

W. M. Ragland: "That leads to a point of where is the man on the ground going to get the information unless the pilot gives it to him. One of the biggest points on enroute weather is the necessity of the man who's out there with the storm, with the icing problem or with the 'top' condition, letting the other fellow know. If we have that information, we can spread it out to the man who's planning a flight, to the dispatcher who's worrying about the fuel or to the pilot who's about to take off. The change in weather that the next fellow passes back to us will help give us a trend to work on, a pattern to establish.

"Despite the great amount of thunderstorm activity this past summer, we were able to give our passengers pretty smooth rides because we snowed everyone under with pilot reports. We've had wonderful cooperation from our crews. By having many pilot reports, we not only had the story of the pilot who was experiencing weather but we also were able to let the pilot 30 or 40 miles behind him know what was going on. He could overhear the conversation. The pilot who presents a flight plan to Dispatch is given the info, and the dispatcher has information he can apply to his planning which may still be several hours away."

A. L. Ueltschi: "I think we should have one VHF frequency for the weather. All communications are becoming heavy. United can't monitor Eastern, Eastern can't monitor TWA, so why not have one VHF frequency piped to the Weather Bureau and let the weather forecaster have a microphone? It could be tied into the CAA transmitter and we could stand guard on that frequency. Most of the airplanes have dual VHF, so if the pilot didn't want to listen to the weather frequency, he could have his copilot do the listening."

Mel Lamb: I'd like to endorse Al's proposal. Unlike the airline pilot, the business-plane pilot is hampered by communications and weather facilities. We may take off at a field having no weather facilities and no communications facilities. If one frequency were assigned to weather alone, we'd have a much better chance of getting

nroute weather ahead of us."

. M. Christenson: *"At this point, I'd ike to introduce a question. Do you con- der the Weather Bureau facilities limited n scope with respect to our mutual flight- peration problem?"*

R. H. Simpson: "Yes, indeed. We very keenly feel the need of more pilot reports han we now receive. For the most part, t is a communications problem, both in eceiving the report and in distributing it or the use of all concerned. However, even if communications were not a prob- em, if the Weather Bureau had to guard pilot weather-report frequency 24 hours a day, we would have a serious staff problem. As it is now, our observers leave the station unattended four times a day when they go out to take balloon runs.

"I believe Mr. Ueltschi's suggestion is a good one, but the Weather Bureau would have to staff differently at many of its stations if this suggestion were adopted. The value of getting pilot reports of weather directly into Weather Bureau forecast centers is that there the reports can be interpreted immediately in terms of forecast charts already prepared. This means that a report of bad weather can be determined to be either the first in a series of important developments or merely an isolated air-mass condition which will remain circumnavigable and be of minor importance to subsequent traffic. This, of course, serves the other important purpose of tipping off the forecaster to developments which will be more accurately reflected in subsequent forecasts.

"In regard to other aspects of in-flight weather service and facilities, our most difficult problems are those of communications. Not only is it difficult to handle pilot reports adequately but it is also a problem to get radar reports, consolidate them and circulate them for the operational use of all concerned.

"Another problem is that of providing adequate weather broadcasts. The Weather Bureau believes that much can and should be done to improve or replace with better facilities the present plan for broadcasting terminal weather over L/MF ranges. One possibility is to implement the present terminal weather with pilot-report information and area forecasts. We have discussed with the CAA the possibility of putting such information on tape and running it continuously. It could be filtered out if the pilot were guarding the beam, or cut-in whenever the latest weather information were needed.

"Weather Bureau aviation forecast centers soon will be making small-area type forcasts corresponding approximately to ARTC areas. These forecasts will be available at all CAA INSAC stations as well as Centers. At present, INSACs have only terminal forecasts available, Therefore, this should be an important step in improving enroute weather services for pilots."

Capt. E. D. Sager: "To me a forecast is an alert to a possible condition over a wide area. What we are interested in is an on-the-spot or up-to-the-moment report of weather actually being experienced at the time. The forecast part is well taken care of."

C. M. Christenson: *"Let's move on to the next part of this discussion. We've mentioned radar and the various technical developments taking place. I think it would be well at this point to introduce some of the known developments underway.*

"Number One is the problem of developing adequate airborne radar. There are several under consideration at this time. many of which are principally related to the military phase of the business. United Air Lines also has under development the airborne radar with RCA. I think it can be said here that our experience to date with this airborne radar has been better than we had anticipated. There were a lot of good thunderstorm conditions existing around Denver this past summer, and the RCA equipment operated very well, although there have been minor failures which are to be expected in prototype equipment. The 5.7 cm frequency has given us excellent results in precipitation penetration. We're getting good training information and also better aircraft intelligence information than we had expected. It all points up the fact that, because of atmospheric conditions, limited communications, etc., it is necessary for us to develop a source of intelligence for the pilot that he has right with him. Despite our ability to forecast weather or observe it from the ground, the problem of inter-communications from ground to airplane is a very real one.

"This summer we also explored the possibilities of what we call our 'Thunderstorm Plotting Board'. Marshall Fay, would you explain this development?"

Marshall H. Fay: "The 'Thunderstorm Plotting Board' was used primarily between Chicago and the West Coast on long-range flights. It was successful and so was adapted for the East, too. It consists of a map of United's routes divided into coordinates or grids of 1° longitude. Each grid is numbered, and when Weather Bureau reports indicate the presence of thunderstorms on or near any segment of our airways, Flight Dispatch radios the word to the pilots, using the code number, B2 and B3 for example. Then the pilot who is listening at that particular time can plot the storm on his grid board. The radio report also gives the known or forecast progress of the storm.

"The grid is actually an 8 x 10 sheet of paper, and the storms can be plotted on it by pencil. I haven't had any personal experience with it, but in talking with the pilots who have, I understand it has given us smooth rides that otherwise would have been rough."

C. M. Christenson: *"Dave, do you have anything to add at this time?"*

Dave Little: "We certainly agree on the essentiality of providing the pilot in the air with his own immediate source of weather information through airborne radar. Lacking that, however, we have found utilization of ground radar to be second-best.

"As you have already indicated, the communication problem is an extremely complex one. I agree with the desirability of communicational assistance on weather, as proposed by Al Ueltschi, but I'd like to point out that achievement of that, while not technically impossible, it is highly improbable for many years to come. In the first place, communications should be on a static-free frequency, which means VHF or UHF. Unfortunately, there can be no party-line communications on VHF. There is one man on the air at a time; if two come on, nobody hears anything.

"As far as using HF is concerned, apparently few people realize that the most expensive commodity man possesses is the frequency spectrum. Once every 5 years, the world—not just the U.S.—sits down and proportions the available frequency spectrum. The last time it was done was about four years ago, at Atlantic City, and as a result American Airlines, for example, is losing half of the few essential HF communication frequencies it's had for the past five years. Meanwhile, our fleet has tripled and our communications load has grown almost 10 times. That's why I say that the achievement of Al's idea is highly improbable.

"There are common frequencies in use today that are available not only to domestic-foreign air carriers but also to business flyers and private pilots as well. We in the domestic airline business have used them successfully this year. Operating between Chicago and San Francisco, United's pilots using this common frequency have guided us through heavy thunderstorm conditions and given us a smooth ride. In the same way, we have been able to help United pilots. That frequency is 126.7 mc. Every airline aircraft now has it and it is common practice today for every pilot to get over on that frequency whenever he runs into the unexpected. We all get over on that frequency to find out who is in the area and to talk our way through it. Every CAA ground facility guards that frequency, too.

"There's no reason why the Weather Bureau could not maintain a receiver guard partially or continually on that frequency and pick up a good deal of information."

C. M. Christenson: *"Certainly, to get precision forecasting it is necessary to know a little bit more about the current weather as it exists, rather than depend on weather information that is six hours old. I believe the meteorologist is just as interested in immediate reporting of enroute weather as anyone, particularly when we get down to disseminating information for the pilot who is planning his trip."*

Norman E. Huseby: "The meteorologist needs all the pilot reports he can get. We have a good network of stations on the ground, and under most conditions it gives us an adequate picture of what the weather looks like to the man on the ground. But what we need is a more complete picture of the weather from a pilot point of view. Pilot weather reports can help us do a better job of forecasting weather from a pilot's point of view. We also need wider and faster distribution of these pilot reports.

"A lot of work has been done during the past few years on his idea of precision forecasting, for example, in regard to thunderstorms. Until a few years ago, the general belief was that there was severe turbulence in any thunderstorm. We know now that this isn't always true. There is a lot of variation in the maximum tur-

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Skyways Round Table

(Continued from page 43)

bulence within thunderstorms; some of them can be flown by modern transport-type aircraft with only slight discomfort to the passengers or possibly without any discomfort at all. We feel that we have made real progress in our own Department in forecasting the degree of turbulence both in isolated air-mass thunderstorms and in those associated with cold fronts or squall lines."

Capt. Charles Blair: "Is there any research and development presently underway in the business of getting something like a teleprinter for aircraft so we can get rid of some of this radio conversation? We're still in the Dark Ages when we depend upon RT and CW exclusively."

Dave Little: "We had radio teletypewriters some 15 years ago and we've been playing with them ever since. To date, however, there is no reasonably satisfactory accurate system. It is practical to attach teletypewriter technique to available radio circuits, either HF or VHF, but due to inherent ignition electrical noise in aircraft and the economic impracticality of keeping that noise at a minimum, the printed circuitry will miss or cause enough errors so that you can't depend on it."

C. M. Christenson: *"Gentlemen, we've gone well over the time allotted us today, which indicates there's a good bit of interest in this specific problem of weather.*

"The experiences of 1953 have indicated that we have a very definite enroute weather problem that is beyond the present solutions we have for it. It is necessary for the industry to whip that problem because the involved liability of modern flight is becoming an important problem in economics. The loss of aircraft equipment and lives in accidents associated with the weather is too high to be satisfactory.

"We have problems in both summer and winter flying. We have the problems of snow, ice and turbulence in the winter, and the problem of snow and ice on a wing is far from solution. The closest approach is the use of chemical solutions which are sprayed on the wings to prevent the adhering of certain types of snow and ice.

"The problem of take-off and climb under reduced visibility conditions has to receive the attention of the aviation industry because of the congested airways and our inability to accurately control VFR flight.

"The greatest stride forward will come the day we have airborne radar equipment on board our aircraft. With airborne radar available and improved communications from pilot-to-pilot, from pilot-to-ground, between Weather Bureau agencies and the meteorologist and dispatcher, and between those agencies and the airplane in the air, then will we have greater precision in forecasting that will lead directly to increased safety and efficiency in flight operations."

DC Fault Protection

(Continued from page 21)

In addition to these advantages, the Eclipse-Pioneer development has another important virtue: it is relatively simple compared to most other fault protection systems. By utilizing only three relays (there are four times this amount in some), complete protection is afforded. From a servicing point of view alone, such simplicity is not to be taken lightly.

Eclipse-Pioneer is no newcomer to the field of electrical protection. It was the first company, immediately after World War II, to have overvoltage protectors in production. As aircraft generators grew bigger—with wider speed ranges—it became obvious that a greater danger existed should faults occur. The present system evolved from this realization.

If the transport described in the beginning of this article had been equipped with such a protection arrangement, the overvoltage condition which caused the near-disaster would have been eliminated. The system's generator circuit breaker would have tripped before such a state of affairs could have persisted for an unsafe period of time.

The fault-protection system is so devised that the time delay before a faulty circuit is opened ranges from one and a half seconds for a voltage just exceeding the trip value (approximately 30 volts) down to 20 milliseconds for overvoltages exceeding 80 volts. The inverse time delay is featured to prevent transient overvoltage disturbances due to normal functions from causing false trips, but to trip immediately upon severe overvoltages.

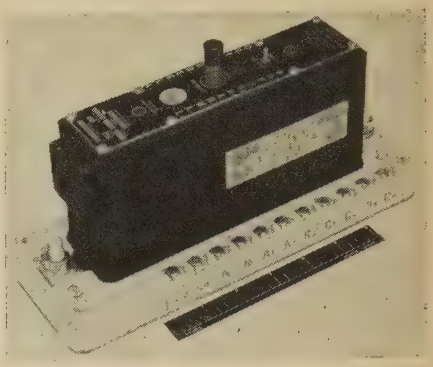
An arrangement can be chosen to detect and clear either light and heavy faults to ground, or heavy faults alone. In the latter case, which involves faults in excess of 300 amperes, the ground fault detector reactors and the light ground fault detector relay are not needed. Use of the fault current itself to trip the breaker provides maximum speed of combined detecting and clearing of a heavy fault, as only the time delay of the breaker itself is involved.

If the ground fault reactors and relay are used, the most complete coverage is assured. The speed of detecting and clearing faults to ground in very rapid ranging from 50 milliseconds down to eight milliseconds. Because of certain inherent qualities, reactors are exceptionally free from the tendency to give false trips under conditions of transient loads, wide temperature differences between two reactors, and lead resistance changes.

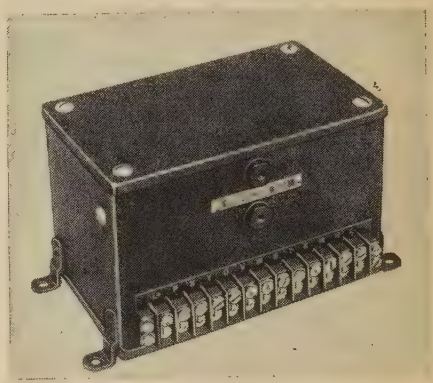
If for any reason the feeder contactor or reverse current relay should fail to open when the corresponding generator is made inoperative, a reverse current through the breaker, exceeding 300 amperes, will cause the breaker to trip itself. The tripping time is an inverse function and ranges from approximately three seconds at 300 amperes, downward to approximately eight milliseconds for large reverse currents. This inverse delay is necessary to allow the reverse current relay to operate for all normal conditions of reverse currents.

Thoroughly impressed with the additional safety afforded by this Eclipse-Pioneer system, the Consolidated Vultee Aircraft Corporation has ordered them for all their new Convair 340's. This means that in the near future such well-known airlines as Braniff, United, Delta-C&S, National and Hawaiian will be carrying the new equipment.

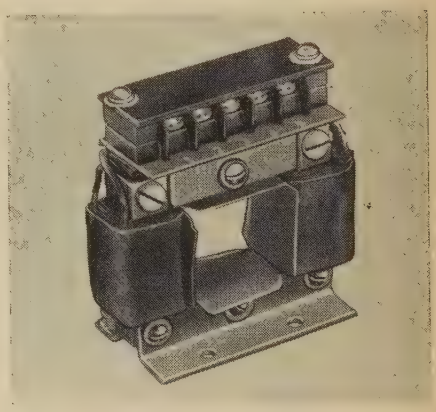
DC Fault Protection System



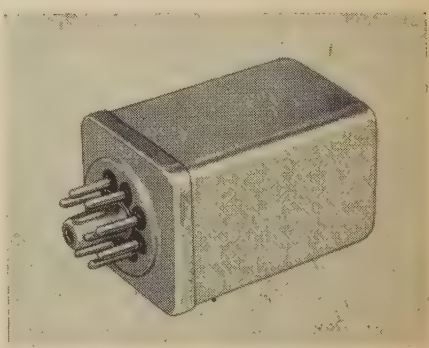
Generator Circuit Breaker



Fault Detecting Panel



Ground Fault Detector Reactor



Light Ground Fault Detector Relay

High Altitude . . .

(Continued from page 15)

to give every consideration to maintaining cabin pressure even after a series of mechanical failures.

The CAA today requires American operators to carry protective oxygen equipment of varying measure, depending upon minimum flight altitude and duration as a function of enroute terrain. TWA's transports go beyond minimum CAA requirements in this respect in that oxygen protection is provided for 100% of the airplane occupants for the maximum time the airplane must remain over high terrain. This is to provide reasonable flight comfort and safety against the proven remote contingency that cabin pressure will be lost. We think most passengers would agree that it was a prudent decision to so equip our aircraft, even though considerable weight penalty was involved. It seems hardly consistent to say that, because the problem of providing passenger protection is more difficult at the higher altitudes, such protection is unnecessary.

While jet transports flying over the Continental U.S. probably will be able to descend to acceptable airports in emergencies without serious loss of range considerations, this is not likely to be the case in transoceanic service. Since the range of the jet is dependent to a large measure on flight at high altitudes, it may be necessary to flight plan against the contingency of cabin-pressure loss. If the airplane is to get to its destination, some acceptable altitude limit must be established. Enough is known about this problem already to say that with the immediately foreseeable jet engines, such an altitude will be above acceptable limits for passengers not equipped with oxygen protection when the aircraft are scheduled on long flights. Therefore, it appears that complete oxygen distribution systems with very considerable quantities of oxygen must be carried in the high-altitude transports to maintain reasonable comfort and health standard in cases of complete pressurization-system failure.

The need seems to exist for considerably more knowledge of physiological limits at altitude when related to the jet transports' operating parameters. Some experts in this field have established that the limit of useful consciousness is 45 seconds at an altitude of 35,000 feet, 25 seconds at 45,000 feet, and 15 seconds at 50,000 feet. Other experts indicate a somewhat greater period of useful consciousness, but in any event it is short.

Much data exists relating to hypoxia. This generally indicates flight crews should use supplemental oxygen during sustained flights at pressure altitudes in excess of 10,000 feet.

The requirement for supplemental oxygen for passengers is not so stringent because passengers are considerably less active than the flight crew and so will have a much greater tolerance to hypoxia at any given atmosphere. It is generally accepted that passengers should be provided with supplemental oxygen protection at pressure altitudes in excess of 14,000 feet. As altitudes are increased,

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AIRPORT SERVICE GUIDE

An up-to-date, accurate, detailed listing of aircraft services and products available to single and multi-engine operators throughout the U.S.

ARKANSAS

FORT SMITH—Fort Smith Municipal Airport—Hangars $1.50 nite, $12.50 mo; no tie-dwn fee; *ESSO & TEXAS* 80-91-100; line svce 7 a.m. to 10 p.m.; A&E; major multi-eng, radio & airframe, minor instru; *CESSNA & NARCO* dealer, *CESSNA* eng. prts. Taxi, limousine, *HERTZ;* wash, polish, paint, clean svce for non-sked arcrft; pilot lnge, Esso & Texas crdt crds; food on arprt 7 a.m. to 10 p.m.; lodging Fort Smith; food to go delivered to arcrft on notice. Airport: 4.5 mi SE; el 460; lat 35-20, long 94-22; Little Rock chrt; no lndng fee for private arcrft; CAA com sta, 24-hr oper; 2 concrete runways, longest 5300; obstr, hill NW; lights, teletype, rotating beacon. Bob Smith, Mgr, Tel 2-6363. Airlines: BNF.

ARIZONA

WINSLOW—Winslow Municipal Airport—Concrete-steel hngr, storage fees on wing span; tie-dwn $1.50 nite; *STANDARD* 80-91-100-110; line svce 24 hrs, three A&E; major sing & multi-eng, arframe, instru & radio; prts all eng types; new & used arcrft parts, supplies & instru; all arcrft svces. Dealer: *CONTINENTAL, LEAR, LYCOMING, FRANKLIN, CESSNA, BEECH BONANZA, NARCO.* Taxi, limousine, *AVIS;* food adjacent to arprt 24 hrs; lodging adjacent arprt; pilot lnge; food to go delivered to arcrft 20 minutes notice. Airport: 3/4 mi SW; el 4937; lat 35-01, long 110-43; no lndng fee; CAA com range, tower, unicom 24 hrs; Prescott sect chrt; lights, beacon, teletype, weather; three paved rnwys, longest 7500, unobstr approach. George S. Oberdorf Mgr, Tel 656. Airlines: FAL, FLYING TIGER, PENINSULAR, SLI, RESORT, TRANS-CARIBBEAN.

FLORIDA

FORT LAUDERDALE—Broward County Airport—*RILEY AIRCRAFT MFG:* Henry Reichelt Mgr., Tel. 3-1541; Group hangar, storage based on type of arcrft; tie-dwn fees day, week, mo; *GULF* 80-91-100; line svce & A&E; major & minor sing & multi-eng & airframe; eng prts; wash, polish, paint. Dealer: *RILEY TWIN.* Taxi, limousine, *AVIS;* weather thru Miami tr; pilot lnge; food ¼ mi 7 a.m. to 7 p.m.; lodging 1/4 mi; Gulf crdt crd. Food to go delivered to arcrft on notice. Airport: 3.7 mi SSW; el 10; lat 26-04, long 80-09; Miami cht; weather, teletype, unicom, beacon, lights; customs, immigration, public health port; 4 paved rnwys, longest 5,000; L. E. Wagener Mgr, Tel 3-1051. Airlines: U. S. Airlines, Mackey Air Transport.

JACKSONVILLE—Craig Municipal Airport—*HAWTHORNE FLYING SVCE:* 1 metal, 10 T hangars; no tie-dwn fee; *STANDARD* 80-91-100; *ESSO* products; line svce, major and minor sing eng, instru, airframe; minor radio & multi-eng; eng prts 65 hp to 1250 hp. Dealer: *LEAR, NARCO, CONTINENTAL, PIPER, BEECHCRAFT, GOODYEAR* (brakes & tires); wash, polish, paint, contract upholster. Company rental car; direct line weather; food Hawthorne grill; lodging 8 mi; pilot lnge; Esso & National crdt crds. Food to go delivered to arcrft 3 hr notice. Airport: 8 mi E; el 48; lat 30-20, long 81-31; Jacksonville cht; unicom 122.8; lights, beacon; 2 paved rnwys, longest 4000. W. Frank Wilkinson Mgr, Tel 98-4568.

MIAMI—Miami International Airport—AERODEX: Carlos Mendonca, Mgr, Tel 64-0611; 2 airline type hngrs, no strage space; $1 tie-dwn fee arcrft not serviced; *STANDARD & SHELL* 91-100; line svce 9 hrs daily except Sun & hol; A&E; major and minor from ramp svce to 8000-hr overhaul; *CAA* Sta 3612; check repair sta limit list. Dealer: *ARC, BENDIX, COLLINS, NARCO, WILCOX;* major & minor radio, approved CAA shop for ARC, Bendix, Collins, Narco, Wilcox, Lear, RCA, others; major & minor instru by AeroSmith, Inc; prts for most P&W eng in stock; wash, polish, paint, clean. Taxi, limousine, *HERTZ, AVIS,* other car rental; pilot lnge; crdt crds for fuel & oil only; Aerodex customer svce dept Tel, 64-0524, 64-7278; restaurants 24-hr svce; lodging adjacent arprt.

SOUTHERN AIR PARTS: Parts and accessories for transport arcrft.

PAN AMERICAN CARBURETOR SVCE: Authorized svce dealer *BENDIX-STROMBERG & THOMPSON* products; overhaul arcrft carburetors, eng-driven pumps.

L.B.S. *AIRCRAFT CORP:* 1 airline-type hngr, no strage, tie-dwn fee $1 day; *GULF & STANDARD* 91-100; major & minor sing & multi-eng; eng, radio, instru & airframe svce same as Aerodex. Dealer: *LODESTAR, DC-3, C-46, BEECHCRAFT;* crdt crds for fuel & oil only.

Airport: 5 mi W; el 5; lat 25-47, long 80-16; tr continuous; radio: LF 365 kc, VHF range 113.5 mc, ILS 109.5 mc, glideslope 332.6 mc (runway 9R); Miami sect cht; 4 rnwys, longest 9400; obstr: trees head rnwy 12; lndng fees range $2.50 to $38.50; prking $1 day. A. B. Curry, Port Dir; Allen C. Stewart, Assist. Airlines: Aerovias Brazil, Aerovias Guest, Avianca, Bahamas, BOAC, BWIA, Cubana, DAL-C&S, EAL, KLM, NAL, PAA, Panagra, Resort, Riddle, irregular carriers.

ILLINOIS

DANVILLE—Vermilion County Airport—2-M & T hangars; transient fees, $2 sing-eng; $6 multi-eng; can accommodate up to *T-Beech;* $1 tie-dwn all types; *TEXACO* 80-91; line svce & A&E day, nite on request; major & minor sing-eng, minor multi-eng; eng prts sing eng; minor airframe; wash, polish, paint, clean. Dealerships eng, radio, aircraft in process. Taxi, *HERTZ;* weather: sequence on field, direct wire with LAF, Insac; pilot lnge; Texaco crdt crds, bill on other crds; food 1 mi from arprt 11 a.m. to midnite; lodging 5 mi. Airport: 5 mi NNE; el 670; lat 40-12, long 87-36; no lndng fee; unicom 122.8, homer beacon 375 kc owned by Ozark Air Lines; Chi cht; beacon, lights; 3 paved rnwys, longest 4000; Thomas R. Kinnucan, Mgr, Tel 4624. Airlines: OZA.

IOWA

WATERLOO—Waterloo Municipal Airport—Storage hngrs, tie-dwn fee; 80-91-100 fuel; line svce 24 hrs, A&E; major & minor sing-eng; *CONTINENTAL* eng prts; major airframe; wash, polish, paint, clean. Taxi, limousine, *HERTZ.* Dining rm, coffee shop terminal bldg 7.30 a.m. to 10 p.m.; lodging, motel 1 mi from arprt. Airport: 5 mi NW; el 867; lat 42-33, long 92-24; no lndng fee; Dubuque cht; unicom 122.8, lights, rotating beacon; 3 paved rnwys, lonhrdy 5400. Walter E. Betsworth Mgr, Tel 3-0595. Airlines: BNF

KENTUCKY

LEXINGTON—Blue Grass Field—*BOHMER FLYING SVCE:* 120x60 hngr; rates $2 to $5 day, $17 to $60 mo; $1 tie-dwn; *GULF* 80-91-100; line svce 8 a.m. to 8.30 p.m.; A&E 8 a.m. to 5 p.m.; major & minor sing eng & airframe, minor radio; wash, polish, paint. Dealer: *CONTINENTAL, NARCO,*

(Continued on following page)

AIRPORT SERVICE GUIDE

(Continued from previous page)

CESSNA. Limousine, taxi, *AVIS*. Food on arprt 8 a.m. to 8.30 p.m.; lodging in Lexington 7 mi; pilot lnge; Gulf crdt crds. Food to go delivered to arcrft on notice. Airport: 7 mi W; el 989; lat 38-02; long 84-36; no lndng fee; tower, radio, weather, lights, rotating beacon; 24-hr oper; T-7, S-7 sect cht; 3 concrete rnwys, longest 4000. O. R. Parks Mgr, Tel 4-5145. Airlines: DAL-C&S, EAL, PAI.

LOUISIANA

NEW ORLEANS—New Orleans Airport—*PETER C. ALSOP:* 160x200 steel hngr, strage & tie-dwn fees; *GULF* 80-91-100; line svce & A&E day, on call 24 hrs; major multi-eng in coop with Pan Air Corp CAA shop; major airframe, minor instru; eng prts for most private & executive arcrft; wash, polish, paint, clean. Taxi, limousine. Food on arprt; lodging on arprt & N. Orleans; *GULF* dealer; *Gulf* & all major oil co. crdt crds. Food to go delivered to arcrft on 2 hr notice.
PAN AIR CORP: 160x200 hngr, strage fees; *TEXACO, GULF, ESSO* 80-91-100; line svce & A&E day hrs; major & minor sing & multi-eng; major airframe, minor instru; standard eng prts; dealer all eng, radio, aircrft; wash, polish, paint. Taxi, *HERTZ*, bus; Tel Evergreen 3101; food on arprt 24 hrs; air-condition pilot lnge. Food to go delivered to arcrft, no notice.
MIRAMON AIRPORT SVCE: Wilson A. Miramon Mgr, Tel Victor 1150; hngrs, tie-dwn; *TEXACO* 80-91-100; line svce 24 hrs; major sing & multi-eng; major radio & airframe; minor instru; *AIRCRAFT RADIO SUPPLY CO:* Metal hngr; dealer & distributor all types radio & electronic; major & minor all types radio install, minor electronic; Tel Valley 8551, Victor 3039.
Airport: 6.5 mi NNE; el 6; lat 30-02, long 90-01; 3 paved rnwys, longest 4000; obstr: P-line S, SE; control tr, weather, radio, unicom 122.8 mc. Charles P. Collins Mgr, Tel FR 3161

OHIO

CINCINNATI (Covington, Ky.)—Greater Cincinnati Airport—*BOONE COUNTY AVIATION:* Brick hangar, storage fees $2 to $10; $1 tie-dwn; *STANDARD* 80-91-100; line svce 8 a.m. to dark, on call nite; A&E avail all time; major & minor sing & multi-eng; major & minor airframe, incl air condition. Dealer: *NARCO, CESSNA, MOONEY*. Taxi, limousine, *HERTZ*, bus; tel in hngr; air-conditioned pilot lnge; Standard crdt crds. Sky Chef food 7 a.m. to 11 p.m.; Airport: 10 mi SW Cincinnati; el 890; lat 39-03, long 84-40; lndng fee multi-eng only; control tr, radio, weather, lights, beacon, ILS; 4 paved rnwys, each 5500. Robt Isenber Mgr, Tel HE 5600. Airlines: AAL, DAL-C&S, LCA, PAI, TWA.

OKLAHOMA

TULSA—Tulsa Municipal Airport—*SPARTAN AIRCRAFT CO:* Hangars, eng overhaul, eng build-up, instru & radio bldgs, arcraft overhaul svce ramp; transient fees: small sing-eng $2, arge sing-eng $4, small twin $5, large twin $10; no Spartan tie-dwn, city provides; *SKELLY* 80-91-100; line svce 4 a.m. to 12.30 a.m.; A&E 8 to 5; major & minor sing & multi-eng, radio, instru & airframe; wash, polish, paint, clean. Eng prts P&W, Wright, Lycoming, Jacobs, Continental; dealer: *COLLINS, NARCO, ARC, BENDIX, SPERRY*. Taxi, *AVIS;* 3 pilot lnge; crdt crds Pure & Skelly; complete map coverage. Sky Chef food 24 hrs; Spartan cafeteria, 6 to 10, 11 to 2, 4.30 to 7.30; motels 3 to 5 mi radius; Spartan Tels, 8-4491 dav, 8-4496 nite. Airport 7 mi NE; el 674; lat 36-12, long 95 64; no lndng fee; control tr, radio, teletype. ILS, weather, lights, beacon, 24-hr oper; 6 concrete rnwys, longest 10,000. Charles W. Short, Jr. Mgr, Tel 8-4411. Airlines: AAL, BNF, CAL, CEN, OZA.

NORTH CAROLINA

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NORTH DAKOTA

BISMARCK—Bismarck Municipal Airport—Frame hangars, strage fees $1 to $4.50 nite sing-eng, $15 to $25 mo; $7.50 2-eng nite, Lodestar $12.50 nite, DC-3 $15 nite; no tie-dwn fee; *PURE OIL* 80-91-100; line svce & A&E 24 hrs; major main all types, minor overhaul multi-eng; major radio & airframe, minor instru; Continental, Franklin, Jacobs eng prts. Dealer: *CONTINENTAL, FRANKLIN, CESSNA, PIPER, TAYLORCRAFT, MOTOROLA, NARCO;* wash, polish, paint, clean. Taxi, limousine, *HERTZ;* svce Tel 151. Food on arprt 7 to 7, on call later; lodging Bismarck; 3 pilot lnges; Pure Oil, other crdt crds. Food to go delivered to arcrft on notice. Airport: 2.5 mi SE; el 1653; lat 4646; long k00-45; no lndng fee; CAA tr; LF omni, ILS, VHF 126.7, 122.1, 135.9, 121.5, 255.4; 24-hr oper; Fargo sect cht; 4 paved rnwys, longest 5240; obstr: trees S, E, fence NE; glide angles, 17:1 S, 20:1 E, 0:1 NE. lights, beacon. Raymond V. Heinemeyer Mgr, Tel 254. Airlines: BNF, NWA.

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High Altitude . . .

(Continued from page 45)

supplemental oxygen requirements become more severe. At 33,000 feet, 100% supplemental oxygen concentration should be used. At 42,000 feet, it is necessary to administer 100% supplemental oxygen under positive pressure of about 6½ inches of water. At 50,000 feet, 100% supplemental oxygen concentration must be used under positive pressure of about 12 inches of water. When using pressure-breathing equipment, muscular contraction of the chest and neck muscles is necessary to overcome the system back pressure when exhaling. In addition to placing a practical altitude limit on use of the equipment, this requirement also places a practical time limit, believed to be approximately 15 minutes at a 50,000-foot pressure altitude, for its use because of fatigue of the chest muscles. Of course, this is for non-pressurized operation.

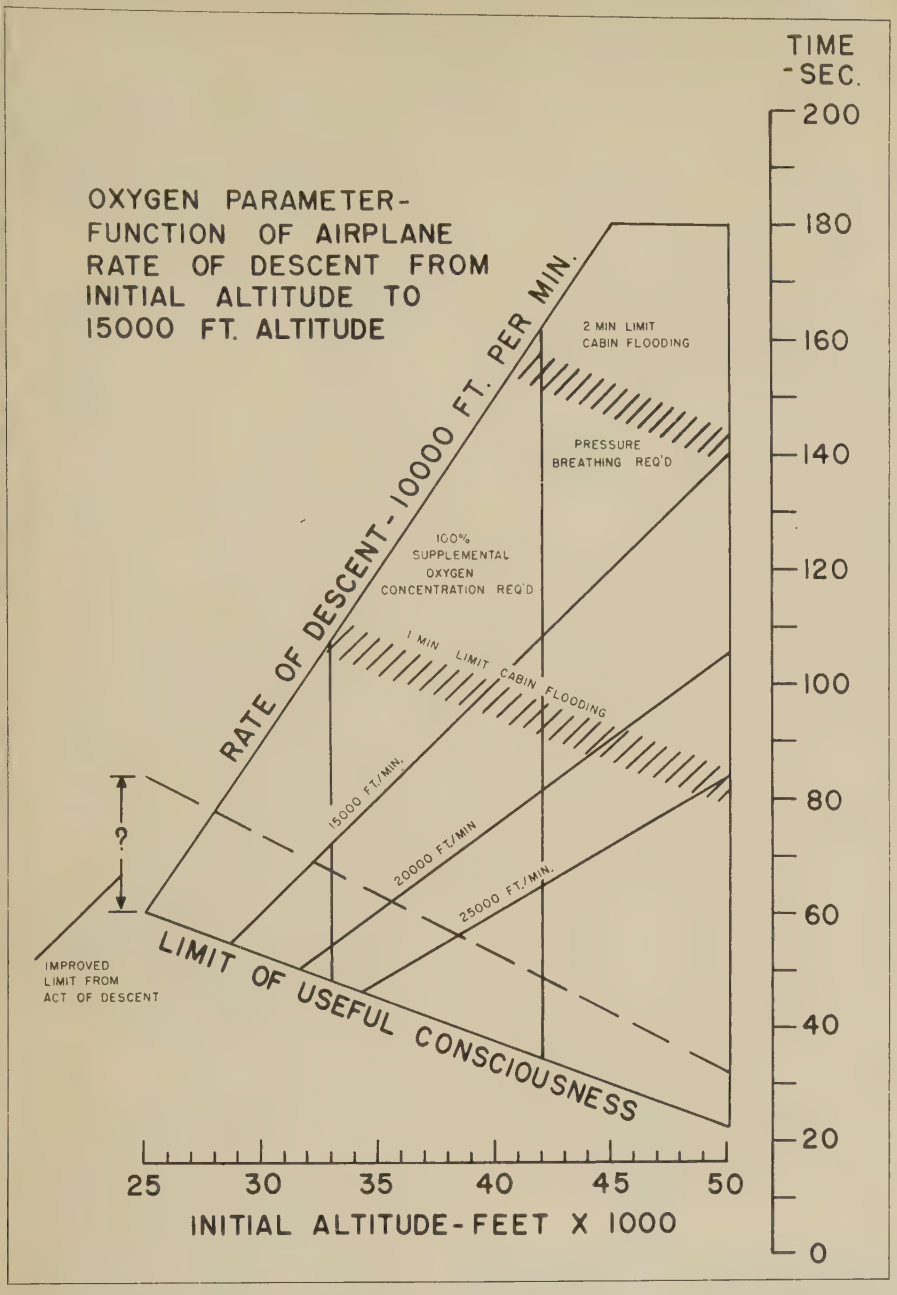
While crews on the jet transports will be provided with complete oxygen protection, it is believed impractical to provide pressure breathing masks for the passengers since these masks must be individually fitted to be pressure tight.

With respect to instantaneous decompression, it should be remembered that in all probability pressure loss will not be immediate. With the cabin-pressurization system working properly and with some compromise in window size as regards current transports, a definite element of time will exist from the time of aperture failure until the time pressure equalization is obtained. It is assumed that dump valves will be immediately closed in event of blowout and that the cabin-pressurization system will be brought into full operation immediately. This, coupled with the time required to exhaust the cabin through relatively small apertures, should eliminate concern over permanent ill effects from instantaneous depressurization. This also provides additional time to bring the aircraft down to altitudes where pressure breathing is unnecessary. Until quickly adaptable pressure masks or the equivalent are available, it will be necessary to rely primarily on quickly obtaining a very high rate of descent when operating at altitudes of 42,000 feet and above. These high rates of descent will very materially reduce the risk of exposure to hypoxia. It is not believed, however, that rates of descent alone can suffice. Therefore, if a reasonable degree of protection is to be afforded against the contingency of pressure blowout or cabin pressurization-system failures, some system for flooding may be necessary in addition to individual masks.

By referring to the graph on page 47, you will see that if a 10,000-foot-per-minute emergency rate of decent is obtainable, two minutes of flooding the cabin with oxygen or the equivalent is required if blowout occurs at a pressure altitude of 40,000 feet. This does not consider the period of time it will take the crew to secure the airplane in a stabilized dive nor does it consider the improved limits of useful consciousness that will be obtainable while descending to the lower levels. It is assumed that descent to

15,000-foot levels will suffice, at which time the cabin crew will be able to determine that passengers are adequately protected with oxygen masks or the equivalent.

a carefully planned distribution system lest the blowout occur adjacent to the exit of a single-point flooding system, in which instance the oxygen would simply



Cabin crews, of course, will require immediately usable walk-around equipment.

If the jet aircraft has an allowable emergency rate of descent of 15,000 feet per minute, only one minute of cabin flooding or the equivalent would be required. If, on the other hand, the airplane is operating at a 50,000-foot elevation and has a 15,000-foot-per-minute emergency rate of descent, something over two minutes of cabin flooding would be required.

Probably the maximum practical emergency rates of descent for jet transports will be on the order of 17,000 to 20,000 feet per minute. If this is actually obtained, the problem will be greatly relieved but not necessarily solved.

As far as flooding the cabin with oxygen is concerned, certain practical limitations are obvious. For example, such flooding probably would have to be through

be blown to the exterior of the airplane. Also, cabin flooding will be useless at altitudes where pressure breathing is a necessity. In addition, the system design would have to be such that oxygen concentrations which could cause fire hazards would be avoided. It is also quite possible manufacturers will devise some practical means for a crew to reseal certain blowout areas in flight, if those areas were not too large. This would enable relief by repressurization.

Certainly a very good and substantial reason exists for believing that the American manufacturers and designers will meet the challenge presented by very high altitude commercial passenger operations, that the problem will be vigorously attacked, and satisfactory and acceptable solutions insuring flight safety under adverse conditions will be evolved.

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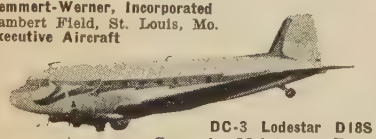

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(Continued from page 17)

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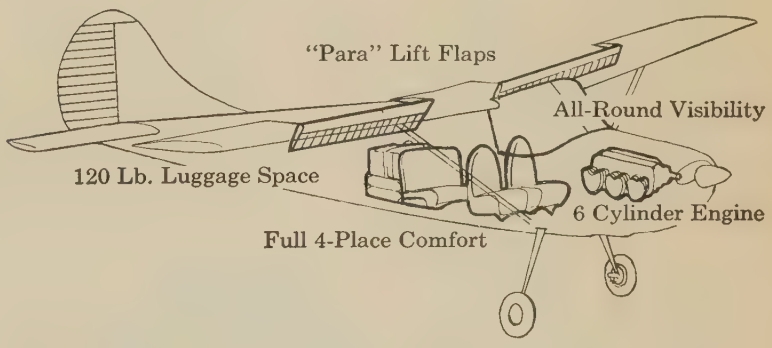

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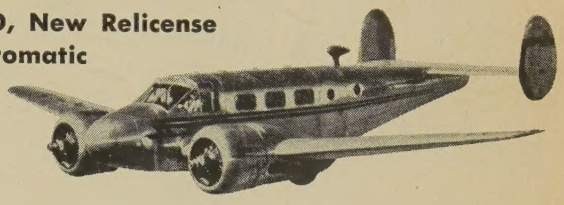

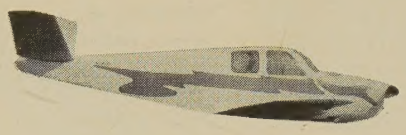

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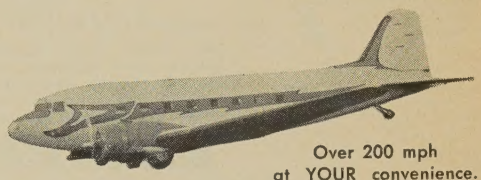

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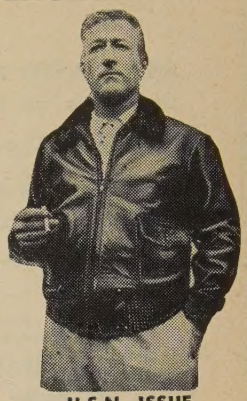

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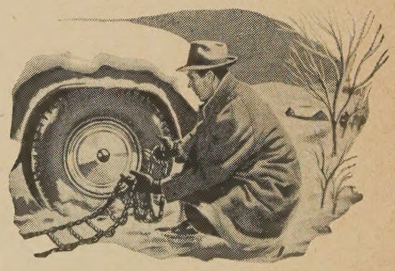

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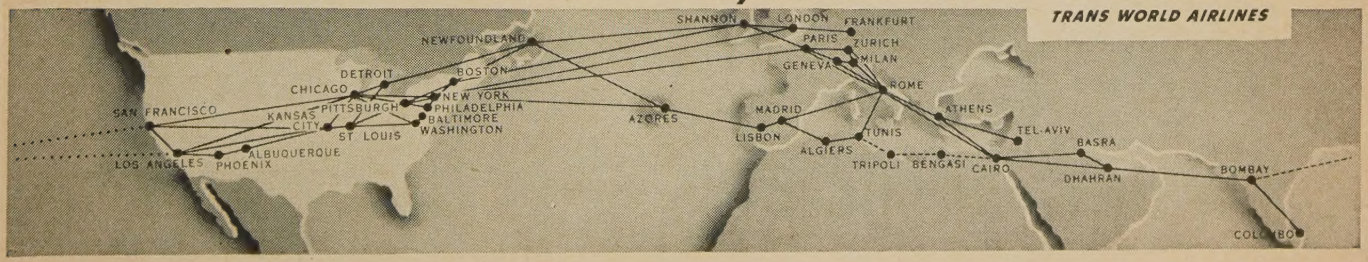

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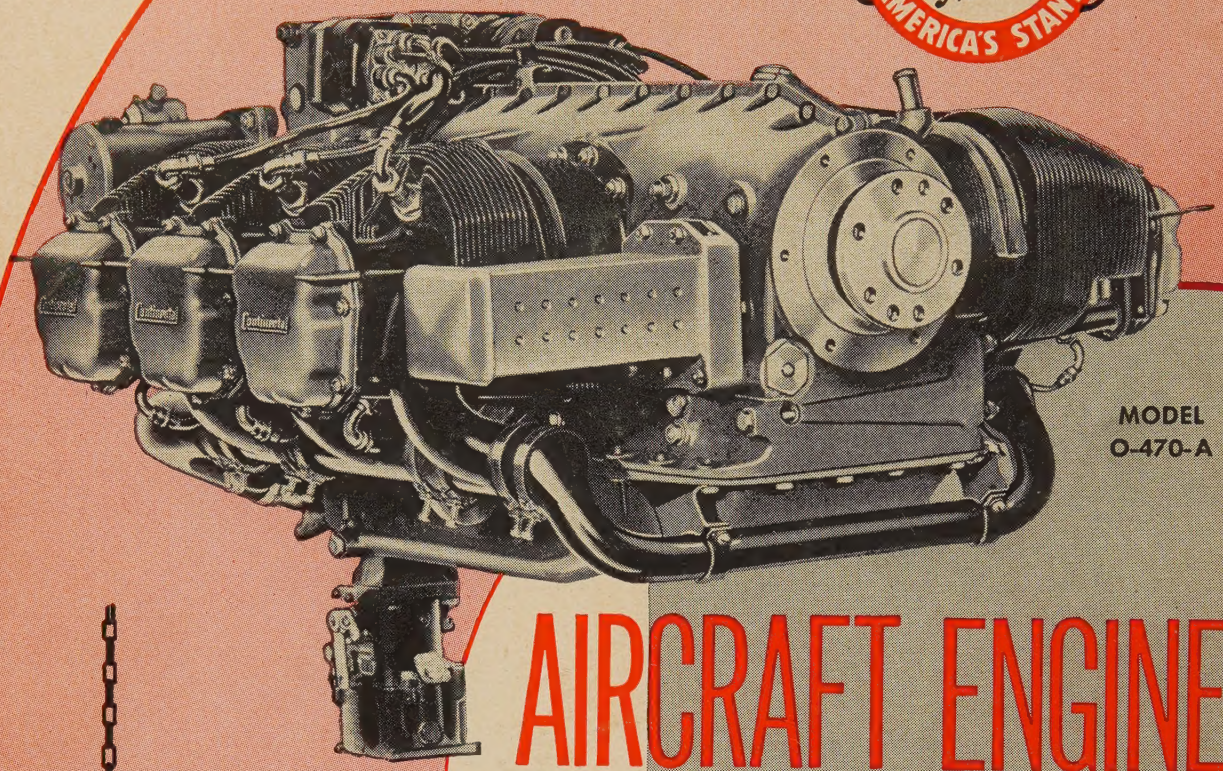

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